American Machinist
Volume 58 NEW YORK, MAY 31, 1923 Number 22

Grinding Manganese-Steel Castings

By HOWARD CAMPBELL
Western Editor, *American Machinist*

Grinding operations on manganese steel parts—Grinding machines made out of lathes, planers and boring machines—Some interesting methods and equipment

THE TOUGHNESS, hardness and malleability which give manganese steel an ability to resist wear and make it the most durable metal known, also limits its usefulness. For ordinary machine parts, the cost of production is out of proportion to their value, but for such parts as railroad frogs, switches and crossings, teeth on steam shovel dippers, dredging machinery, sand pumps, rolls for rock or ore crushers, where the parts are subjected to grinding wear, manganese steel will outwear the best tool steel many times. Manganese steel cannot be cut—it can be finished only by grinding. The methods and equipment described herewith are in use in the Chicago Heights plant of the American Manganese Steel Company.

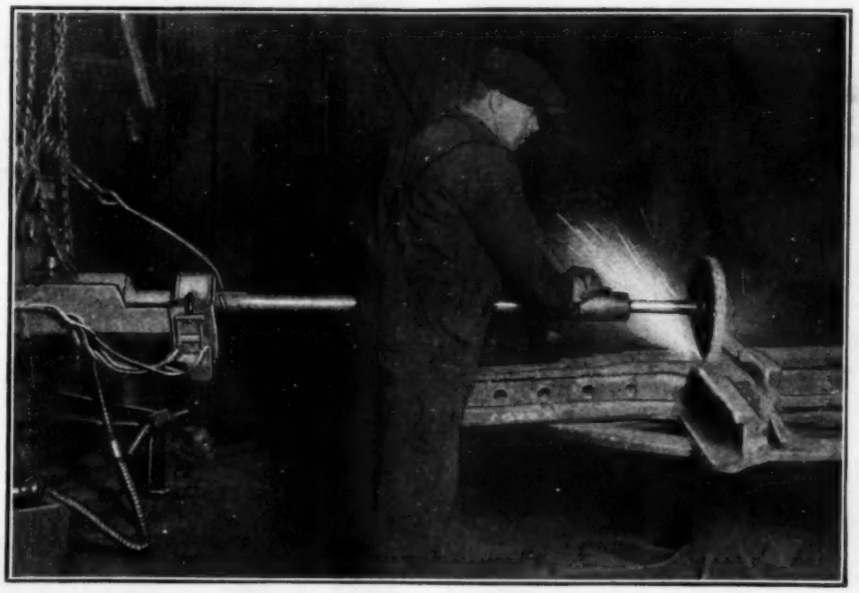


FIG. 1—TRIMMING A RAILWAY CROSSING

The operator shown in Fig. 1 is grinding out the wheel clearance in a railway crossing, using a machine that is suspended from an overhead rail. The machine consists of a platform bearing a Western Electric 5-hp. induction motor, coupled to a shaft that runs in a long sleeve. On the outer end of the shaft is mounted a 14x1x1½-in. 14-Q Norton wheel, which runs at a speed of 1,800 r.p.m. The machine is suspended at a point that equalizes the weight so the spindle can easily be swung about by the operator.

Another machine that is very handy for grinding the rough surfaces from odd-shaped castings is shown in Fig. 2. This is a Strand flexible-shaft grinder, driven by a Western Electric 3-hp. motor running at 1,800 r.p.m. The flexible shaft allows the wheel to be held in practically any position, but an extension has been added that makes it possible to reach 15 in. farther than would otherwise be possible. The extension consists of a 1½-in. steel shaft that slides in a sleeve coupled to the motor. Keys in the shaft, sliding in corresponding keyways in the sleeve, furnish a positive drive. The sleeve runs in Timken bearings in two brackets bolted to the bench as shown. A Precision 10x¾x⅜-in. 36-P, Norton wheel is used and the pieces shown in process of grinding are sections for the interior of rock crushers.

The machine shown in Fig. 3, grinding the face of a 24-in. crane wheel, is a 42-in. King boring mill. One head carries a grinding wheel direct-driven by a Westinghouse motor. The wheel is a 16-O Dayton, running at 1,750 r.p.m. Both sides of the work are ground as close to the dimensions given as the operator can work with a scale, ¼ in. being removed in about 30 minutes.

Another 42-in. boring mill that has been converted into a grinding machine is shown in Fig. 4, grinding the end of the hub on a 33-in. tractor gear. The gear is chucked true with the pitch line as the hole must also be ground before the piece is removed from the machine. The wheel used to grind the face of the gear is similar in grade and grain to the others used on the same class of work, while the wheel that grinds the hole is a 16-Q, Precision wheel, 4x2x¾ in., running at 1,750 r.p.m. The wheel shown in operation is taking a cut of approxi-

FIG. 2—USING A FLEXIBLE SHAFT GRINDER

mately $\frac{3}{32}$ in. About $\frac{1}{4}$ in. is removed from the bore and $\frac{1}{8}$ in. from the hub of the wheel in approximately 25 minutes.

A 10-ft. Niles-Bement-Pond boring machine that has been readapted for grinding can be seen in Fig. 5, grinding the back of a 50-in. bevel gear. The grinding-wheel spindle runs in Timken roller bearings, as do all other spindles that have been applied to machine tools throughout the plant. The spindle on this machine is held in a casting attached to the lower end of one of the rams as

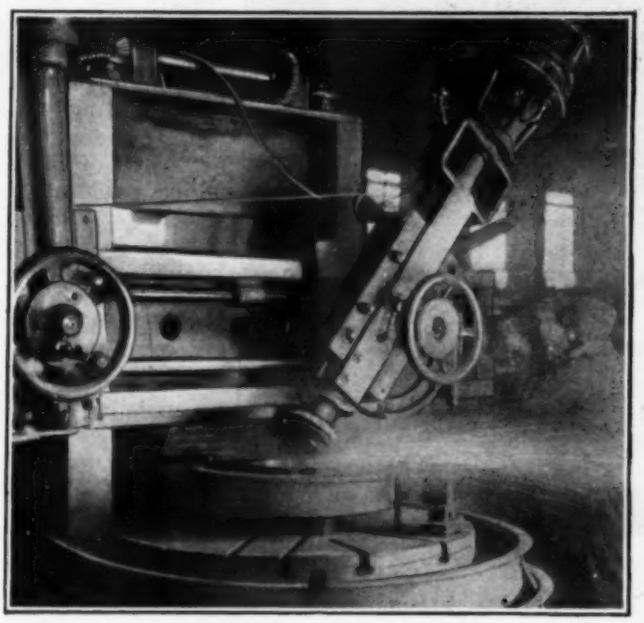


FIG. 3—A GRINDING MACHINE MADE OUT OF A BORING MILL

shown at *A*, while the other ram is bored for a spindle that carries a grinding wheel on its lower end, at *B*. The wheel *A* grinds the back of the hub, removing $\frac{1}{4}$ in. from a surface approximately 15 in. in diameter. This wheel is a 20x2x2-in. 16-P, Norton, running at 950 r.p.m. It is fed automatically across the face of the hub as the table revolves, removing approximately $\frac{3}{32}$ in. at a cut. The table revolves at 20 revolutions per minute.

After the face of the hub has been ground, the bore is ground, using the wheel *B*, which is a 5x2-in. 16-P, Norton, running at 1,750 r.p.m. The hub is 11 in. long and the hole is ground as close to $6\frac{1}{4}$ in. in diameter as the operator can work with a scale. A limit of $\frac{3}{32}$ in. is close enough on the length of the hub. The job usually requires from $1\frac{1}{2}$ to 2 days, "floor to floor."

All Grinding Wheels Are Guarded

Some of the guards that are placed in front of each grinding machine can also be seen in Fig. 5. The frames for these guards are approximately 6 ft. high and the screen is made of wire $\frac{1}{8}$ in. in diameter, woven in 1-in. mesh. The guards are placed in front of and in line with every grinding wheel so that if the wheel should break, the screen will protect those who might be directly in the path of the dangerous flying pieces.

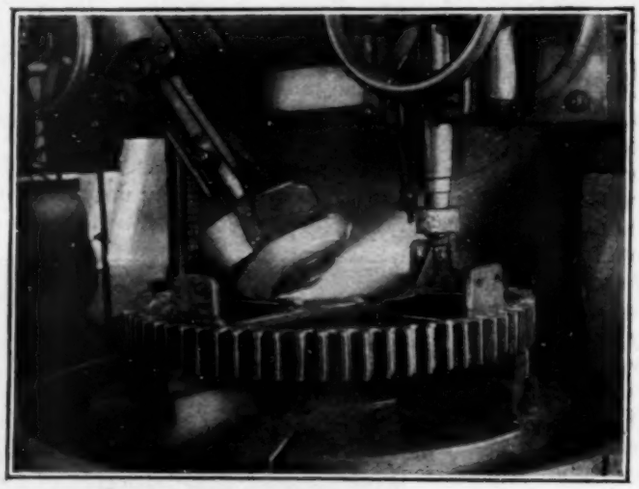


FIG. 4—FACING OFF A TRACTOR GEAR

A machine that will grind work up to 72 in. in diameter is illustrated in Fig. 6, although the piece shown in the machine is only 32 in. in diameter. The machine is a 72-in. Pond lathe, to the slide rest of which a structure has been added to support both the grinding wheel and the motor that drives it. The grinding wheel is a 20x2x2-in. 16-P, Norton and is driven at 1,100 r.p.m. The operation shown is that of grinding the circumfer-

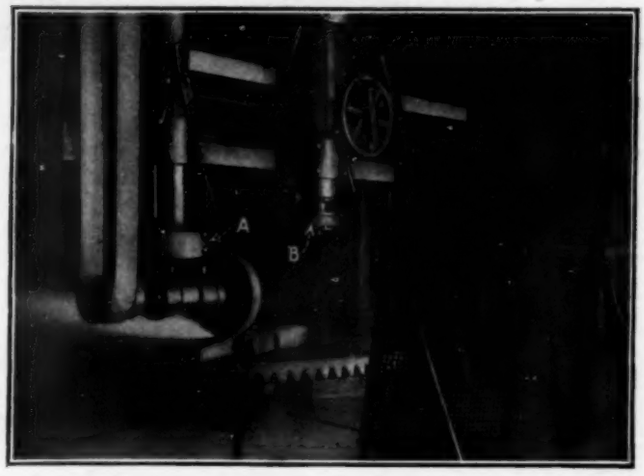


FIG. 5—GUARDS ARE PLACED AROUND EACH MACHINE

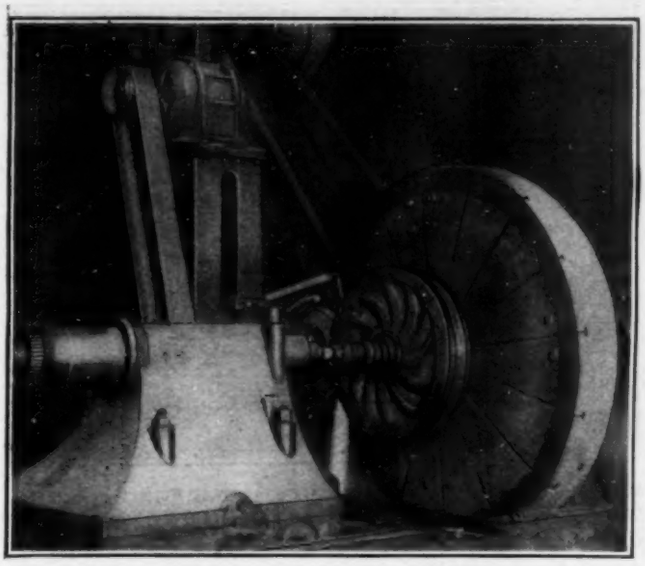


FIG. 6—GRINDING MANGANESE STEEL WHEELS IN A LATHE

ence and inner sides of the flanges, removing $\frac{3}{4}$ in. in cuts of $\frac{1}{4}$ in. The gage is a steel tape used on the circumference of the wheel. The operator works as closely as possible to the graduations on the tape, the actual variation probably amounting to 0.010 in. in the diameter.

Another lathe that has been fitted for grinding is illustrated in Fig. 7. This is a 42-in. Putnam lathe, at work on a plate for a Cutler-Hammer lifting magnet. The construction of the framework that serves as a support for the grinding wheel and its motor can be seen to better advantave in this photograph. The magnet plate is 39 in. in diameter with a 14-in. hole in the center, and is revolving at 18 r.p.m. The grinding wheel is a 16-O, Norton and runs at 1,650 r.p.m. The O grade wheels, which are soft, are used on the thin plates, Q grade wheels, which are much harder, being used on the heavier ones. Obviously, the pressure against the thin section of the plate will not be as great when a soft

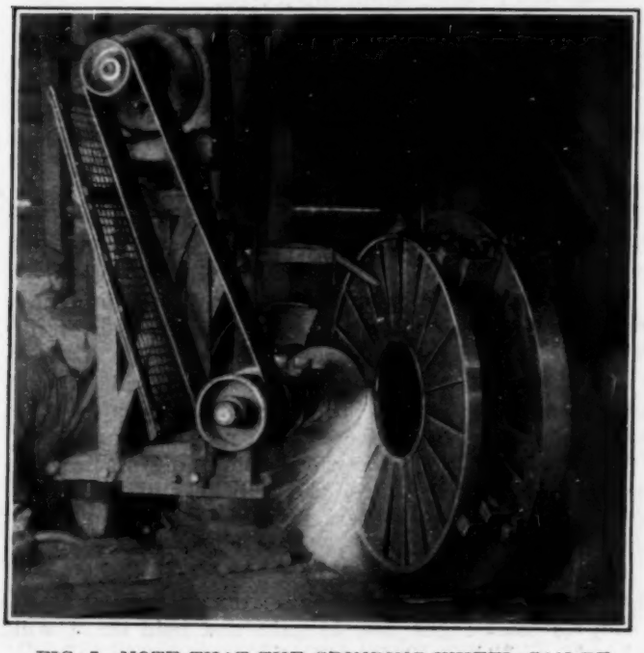


FIG. 7—NOTE THAT THE GRINDING WHEEL CAN BE SWUNG TO ANY ANGLE

wheel is used. The operation shown in the illustration is the second operation on this piece, the first operation being to grind the face of the opposite side and finish the circumference. In order to do this, the plate has to be chucked from the inside of the rim. Water is used as a coolant on this and all similar jobs.

Planers Adapted for Grinding

One of the machines used for finishing plane surfaces where a fairly good finsh and a reasonable amount of accuracy are required is illustrated in Fig. 8. This is a 48-in. Hamilton planer, the tool slide of which has been fitted for carrying a motor and grinding wheel, as shown. The wheel is a 16-P, Norton, running at 1,650 r.p.m. The operation shown is that of grinding a square slot in a roll plate of a large crusher built by the Allis-Chalmers Co., Milwaukee, Wis. The slot, which is 62 in. long, has to be finished with a width of 4 in., with an allowance of 0.002 in. A plug gage is used on this oper-

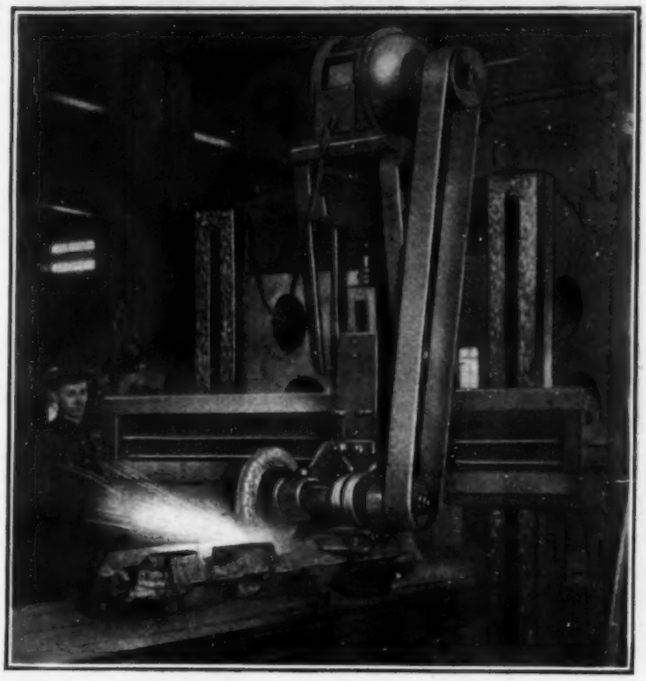


FIG. 8—THE GRINDING WHEEL AS A PLANER TOOL

ation. The work comes to the machine with approximately $\frac{1}{8}$ in. of stock on a side to come off and as the grinding is done on the side of the wheel, only about 0.005 in. is taken off at a cut. The job is finished in 9 hours.

Grinding with an Extension Wheel

The piece shown on the converted planer in Fig. 9, is a cutter head for a dredge for the United States Covernment. The operation in process at the present time is that of grinding the inner surfaces of a tapered square hole, 14 in. long, $8\frac{3}{4}$ in. at the front end and $7\frac{1}{8}$ in. at the rear end. One surface at a setting is ground, the piece having to be re-set between operations. The grinding wheel and the apparatus by which it is operated are shown in Fig. 10. The saddles have been removed from the cross-rail of the machine and a plate has been substituted that carries the structure on which the grinding wheel and its motor are located. The grinding wheel, which is a 6x$\frac{1}{2}$x1, 46-H Carborundum, is located on the end of an arm that is long enough so the hole can be ground without the work having to be

brought dangerously near to the cross-rail. The grinding wheel spindle is very short and the end of the arm is forked, with the pulley in the fork. This is necessary so that the wheel may be changed from one side of the arm to the other in order to grind the surface all the way across, which is done by reversing the spindle and grinding wheel. Clearance is cored out in the corners of the hole, as can be seen by reference to Fig. 9. A sheet metal gage of the length and taper required is used by the operator until the hole is practically finished, then a square-steel gage of the size and length of the hole is used for the final checking-up.

FIG. 9—GRINDING A SQUARE HOLE IN A DREDGE CUTTER-HEAD

There is approximately $\frac{1}{8}$ in. removed on a side, but, due to the spring of the arm on which the grinding wheel is held, the depth of the cut is only about 0.005 in. One hole is finished in approximately 100 hr., of which probably 20 hr. is consumed in handling and setting the work.

A manganese steel rack for a dredging machine is shown in Fig. 11, clamped to a planer table for its final dressing. The machine is a David W. Pond planer which has been fitted for grinding by the addition of a structure similar to that described in Fig. 9. The rack, which is 13 ft. long, is first ground flat, then it is turned over and the ends and tops of the teeth are ground. The wheel is a 20x2x2, 14-RT, Hampden, running at 1,280 r.p.m. Limits of $\frac{1}{32}$ in. are allowed, and the piece is finished in 10 hours.

FIG. 10—GRINDING WHEEL AND ITS SUPPORT

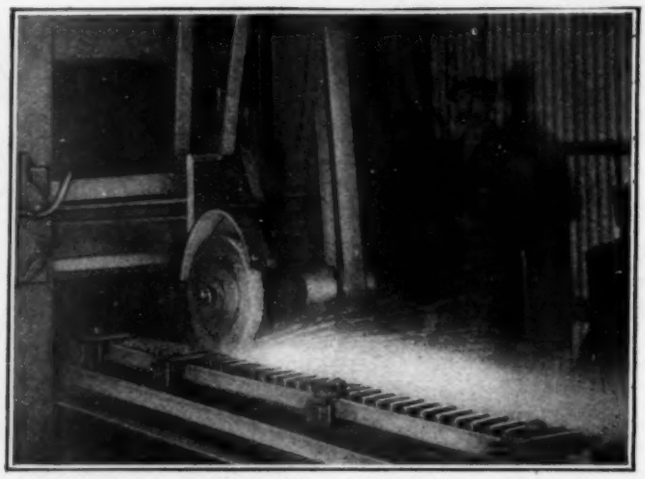


FIG. 11—GRINDING A RACK FOR A DREDGING MACHINE

The Creed of the Shop Foreman

BY H. L. WHEELER

I believe in the work done in my shop, in the firm I am working for and in my ability to obtain the maximum production possible with the tools and with the facilities provided.

I believe that honest and loyal service can be given by honest and honorable men, and such I will require the men under me to be, and by example will endeavor to be myself.

I believe that I can get what I want by working for it, and that my success depends upon my ambition, courage and determination to succeed.

I believe in boosting, not in knocking; in smiling, not in frowning or making alibis; and in initiative, not in waiting to be told what should be done.

I believe that I should study my job and my men and know both well and thoroughly, and I believe that I should give every man a square deal including my employer.

I will find time to do everything that needs to be done and I will not grudge a little extra time when the occasion demands it—time will never find me idle.

I will meet obstacles with a smile and will fight my way through them, and I will make capital of adversity for use in overcoming future difficulties.

I will have the courage to face all difficulties and embarrassment without whining or weakening and will prepare myself to overcome any that I may meet.

I will have faith in the work I am doing, in my employer and in the future, and I believe that reward will come to me if I exert myself in my employer's interest.

I believe that good will may be found everywhere by the right man and that I am that man, and I am ready to start right now to gain and hold it. I will stick to my job until I win.

Factors Governing the Strength of Gear Teeth

BY DOUGLAS T. HAMILTON

The second article — Form and shape of tooth—Inclination of tooth bearing to axis of gear—Strength of helical gear teeth

IN A SPUR GEAR, the tooth lies in a plane parallel with relation to the axis of the gear. This condition, however, is not true of a helical gear in which the tooth is set off at an angle with relation to the axis of the gear. The twisting of the tooth changes its form, its action and also its strength value.

Inclining the teeth on an angle with relation to the axis of the gear brings a greater number of teeth into action. If the helix angle is such as to give a twist to the tooth equal to the circular pitch in the face width of the gear, the teeth are in continuous action or contact at the pitch point in some one plane across the face of the gear. Another difference is that with a spur tooth, the greatest load is taken or carried on the point of the tooth whereas, with a helical tooth, the greatest load is carried in the vicinity of the pitch line. The strength of a helical gear tooth is governed by many more factors than in the case of a spur tooth. Therefore, we will explain these various factors before discussing a graphical method of determining the strength of the teeth.

Diametral and Normal Planes

There is one distinction between a helical and a spur gear which seems to confuse the average mechanic, and that is, that a helical gear can be viewed from two planes, commonly known as *normal* and *diametral*. The diametral plane of a helical gear, as shown in Fig. 4, refers to the outline of the tooth as it is viewed from a position parallel to the face of the gear. The normal plane is the shape of the tooth lying in a plan at right angles to the helix angle of the tooth. For this reason, a helical tooth is always thinner on the normal plane than it is on the diametral plane. Also, the pressure angle and circular pitch are less on the normal than on the diametral plane.

As the width of face of a helical gear and the diametral pitch govern the helix angle of the tooth necessary to give continuous action, it is therefore evident that there is a distinct relation between these three factors—*width of face, helix angle and pitch*. With a helical gear we are not so closely limited to a certain pitch as we are with a spur gear, for the reason that a helical gear tooth is considerably stronger than a spur tooth of the same pitch and pressure angle. The reason for this condition will be subsequently explained.

We can also prove by a diagram similar to that illustrated in Fig. 5, that as the helix angle is increased, the effective load on the tooth is also increased, and that there is a certain point—45 deg.—when the load on the tooth becomes so great that the end thrust is equal to 41½ per cent of the tangential load. It is therefore plain that there is a considerable force tending to separate the two gears, and that this separating thrust also imposes a greatly increased load on the tooth.

We also know that the angle of repose for metals in contact varies between 10 and 15 deg. and as previously explained in connection with the action of a helical gear tooth, the load is carried at the pitch line where the

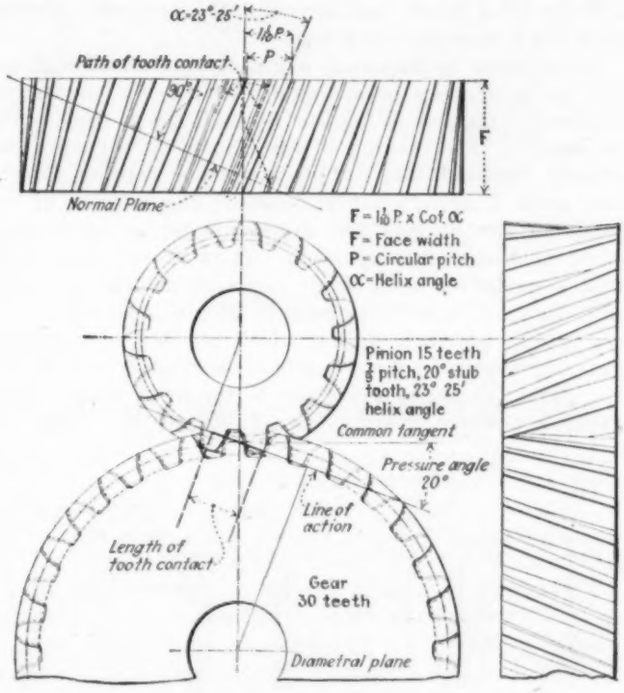


FIG. 4—NOTATION OF ELEMENTS OF HELICAL GEAR TEETH

teeth roll upon each other. At the same time, however, that the teeth are rolling at the pitch line, there is also slippage taking place between the point of one tooth and the root of the mating tooth, or *vice versa*, and this friction to a certain extent tends to reduce the axial thrust, especially when the helix angle is slight.

It is difficult if not almost impossible to determine mathematically the exact relation between axial thrust and helix angle of helical gears. It is evident that friction plays no unimportant part, and as correctly

designed helical gears are always in contact at the pitch line at the same time that the teeth are slipping upon each other in some other plane, it is difficult to determine exactly just what part friction plays in reducing axial thrust.

For all practical purposes we can eliminate the part that friction plays and look at the subject from a theoretical angle. Reference to Fig. 5 will show that the tangential load c on the tooth can be resolved into two components a and b where a represents the total tooth load and b the axial thrust. By the law of triangles, a is the secant of angle α and b the tangent. Therefore, the secant of the helix angle times the tangential load gives the total tooth pressure on the normal section due to the helix angle. The tangent of the helix angle times the tangential load gives the axial thrust.

Assume, for example, that we desire to find the total tooth load and the axial thrust of a pair of helical gears having a helix angle of 15 deg. and carrying a tangential tooth load of 500 pounds.

Total tooth load = sec. 15 deg. $\times$ 500 = 1,0353 $\times$ 500 = 517.6 lb.

Axial thrust = tan. 15 deg. $\times$ 500 = 0.2679 $\times$ 500 = 133.9 lb.

If we still further increase the helix angle, as shown at B and C in Fig. 5, we greatly increase the total tooth load and the axial thrust until, if the angle is increased to 45 deg., the axial thrust equals the tangential load, and the total tooth load becomes 41½ per cent greater than the tangential tooth load.

In addition to imposing a greatly increased load on the tooth, a steep helix angle also reduces the cross-section of the tooth on the normal plane, and hence weakens it, thus making it less capable of carrying the greatly imposed load. This condition can be clearly seen at D, E and F in Fig. 5, where the outlines of the tooth on the normal and diametral planes have been superimposed for comparison. It is therefore evident that a moderate helix angle is to be desired in order that the axial thrust may be kept within practical limits.

For the best action, the width of face of a helical gear, as shown in Fig. 5 should be made equal to $1\frac{1}{10}$ circular pitch times the cosine of the helix angle. This gives a positive overlapping of the teeth. Table IV

TABLE IV—MINIMUM WIDTH OF FACE FOR HELICAL GEARS AND OF CLEARANCE GROOVE

Diametral Pitch	Normal Pitch	Helix Angle α	Minimum Width of Face W Inches	Minimum Width of Face W_1 Inches	Minimum Width of Face W_2 Inches	Minimum Width of Groove C Inches
5	5.184	15° 20′	2 3/32	5 3/32	2 3/32	5/16
5	5.456	23°35′	1 21/32	3 13/32	1 13/32	29/32
6	6.209	14° 55′	2 1/16	4 3/32	2 1/16	19/32
6	6.518	23°	1 23/32	3 9/32	1 11/16	21/32
7	7.254	15° 12′	1 25/32	3 7/32	2 3/32	5/16
7	7.629	23°25′	1 9/16	2 13/32	1 13/32	5/16
8	8.279	14°55′	1 3/4	3 1/4	1 27/32	17/32
8	8.691	23°	1 1/32	2 21/32	1 5/16	17/32
9	9.324	15° 9′	1 27/32	3 7/32	1 13/16	17/32
9	9.801	23°20′	1 3/8	2 13/16	1 11/32	9/16
10	10.349	14°55′	1 1/2	2 3/32	1 3/32	1/2
10	10.863	23°	1 3/16	1 31/32	1 3/32	17/32
12	12.418	14° 55′	1 3/16	2 3/16	1 21/32	1/2
12	13.036	23 °	1 1/32	1 5/8	1 1/16	17/32

gives the widths of face for helical gears of different pitches and helix angles, the latter being based on the Fellows Gear Shaper Co. standard, such as plain helical, matched and herringbone gears together with the minimum width of the clearance groove.

For herringbone gears of the matched type, the width of face should be made equal to twice that of a plain helical gear, plus the width of the clearance groove which must be provided for the cutter to run into. The width of the clearance groove is governed by the pitch and helix angle of the tooth, and should never be less than ¼ in. For herringbone gears of the staggered tooth type, the width of face should be made equal to that of a plain helical gear, plus the width of the clearance groove. Table IV gives total face widths for plain helical, matched herringbone and staggered herringbone gears. In the case of herringbone gears, the width of the clearance groove, listed in the last column, is included in the column giving the total face widths.

Strength of Helical Gear Teeth

While the spur form of tooth has received considerable attention from the standpoint of strength, practically nothing has appeared on the strength of helical gear teeth. It is impossible to give any rule or formula for calculating the strength of helical gear teeth, which can be universally followed. The conditions that arise in each case must be considered separately, and as all of these conditions are seldom known, any rule or formula must be considered as approximate only. In the following an attempt will be made to analyze some of the most important points that must be considered in determining the strength of a helical gear tooth.

A study of the tooth action of a helical gear, reveals the fact that it must be considerably stronger than a spur gear of the same pitch and pressure angle, for the reason that there is always a greater number of teeth in contact, and the tooth action is different. The diagram in Fig. 4 should illustrate this fact clearly. Another reason is that the greatest load is always carried in the vicinity of the pitch line. In the following we will endeavor to show how it is possible to determine the weakest section of the tooth and where the greatest load is carried.

Turning our attention again to Fig. 4, we see that if the teeth are laid out so as to give continuous helical action, they are always in engagement at the pitch line in some one plane across the face of the tooth. Therefore, instead of the teeth being subjected to the greatest stress on the weakest section of the tooth, as is the case with spur gears, the load is carried on a section of the tooth which is capable of resisting considerably more pressure than if it were applied at the point of the tooth.

We can illustrate this in a simple manner, as demonstrated in Figs. 6 and 7. In Fig 6 are shown two helical gears in mesh in two positions. The gear which is of ⅝ pitch, 30 teeth, 20-deg. pressure angle, and 23-deg. 25-min. helix angle, is in mesh with a pinion having 15 teeth. Evidently the pinion tooth is the weaker, so we will determine the path of contact on the pinion tooth.

The diagram illustrates that there are three teeth of the pinion in contact with the gear in some plane, and these have been numbered *1*, *2* and *3* in one position and 1_1, 2_1 and 3_1 in the other. The first position, shown by the full lines in Fig. 6, is the position that the pinion has relative to the gear at the starting point of engagement near the base circle. In Fig. 7 at *A*, teeth *1*, *2* and *3* have been drawn in elevation so as to locate the "path of contact" across the face of the teeth when the gears are in a stationary position.

In order to construct diagrams such as are shown in Figs. 6 and 7, the teeth of the gear and pinion are laid out on an enlarged scale. The line of action is drawn in its proper position tangent to both base circles. The

starting point of action for the pinion is located at the point where the outside diameter of the gear cuts the line of action. In Fig. 6 the full lines show the gear and pinion in this position.

The next step is to lay off on the line of action a number of divisions which will equal the distance on the line of action indicating that width of face. The teeth in this case have been made of sufficient width so that they overlap the circular pitch by one-tenth of the circular pitch in the face width. This portion of the line of action, is therefore split up into eleven equal divisions. A series of lines are then drawn from the center of the pinion to the outside circumference.

Next, three diagrams are laid out indicating an elevation of teeth *1*, *2* and *3* at *A* in Fig. 7. The width of face of these diagrams is also split up into eleven equal parts. The next step is to transfer the "path of contact" to the face of the gear teeth in Fig. 7. This transference is accomplished by measuring the distance from the outside diameter of the pinion to the line of action for the various divisions, and transferring these to the diagram at *A* in Fig. 7. When the points are connected, the line locates the "path of contact" on the various teeth.

In this particular case it will be noticed that the path of contact crosses the pitch line at a point considerably to the left of the center of tooth *2* and runs out of contact before the total face width is reached. Contact on tooth *3* overlaps this, whereas tooth *1* has only point contact. Taking an average from the point *a* to *b*, where contact starts in and runs out on the pinion tooth, brings the average slightly inside the pitch line, or at point *c*. This is the best possible condition for strength with this particular ratio of teeth. The worst possible condition is illustrated at *B* in Fig. 7 and in Fig. 6 by the dotted lines.

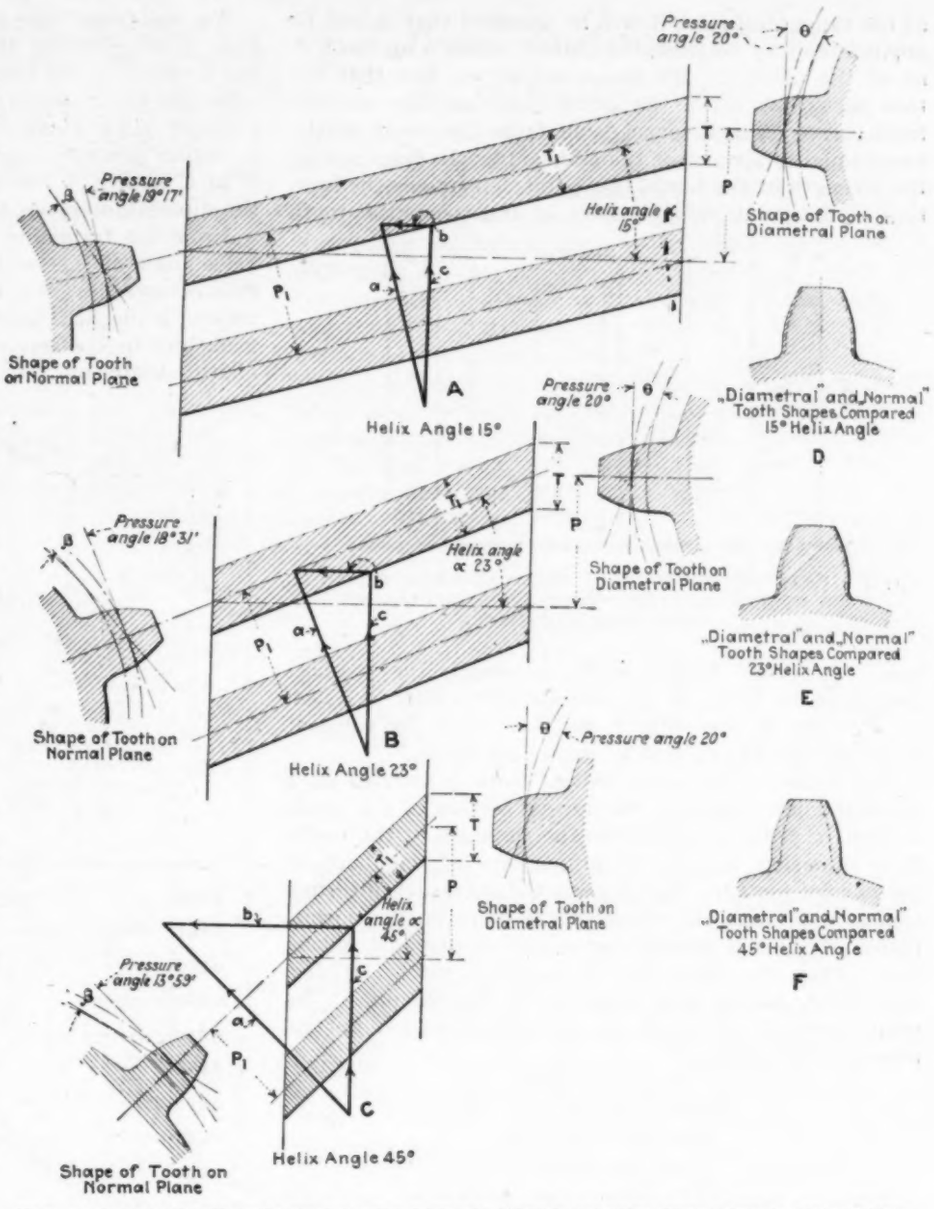


FIG. 5—HOW AN INCREASE IN THE HELIX ANGLE INCREASES TOOTH PRESSURE AND AXIAL THRUST

Diagram *B* in Fig. 7 is constructed in exactly the same manner as diagram *A*, except that to obtain the "path of contact" for this diagram, pinion tooth 2_2, as shown by the dotted outlines in Fig. 6, is brought so that its extreme point contact with the flank of the gear tooth. This shows the weakest possible condition for the pinion. Reference to diagram *B* Fig. 7, will show that contact on tooth *1* is for three-elevenths of its face width. Contact on tooth *2* runs completely across its face, whereas the contact on tooth *3* covers only one division, and that at the extreme point of the tooth.

To determine the location of the point of application

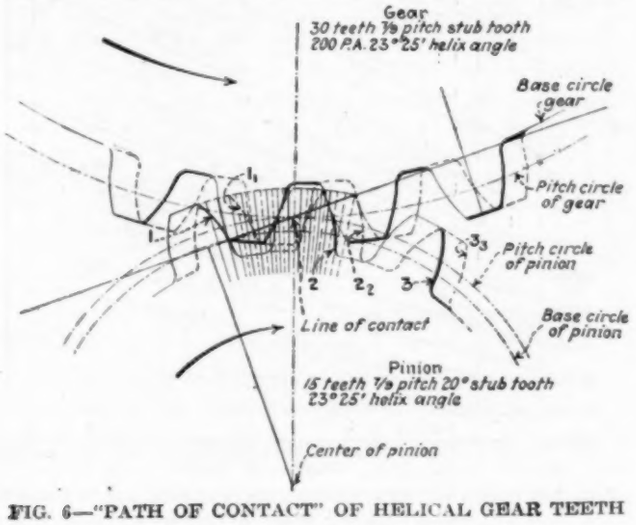


FIG. 6—"PATH OF CONTACT" OF HELICAL GEAR TEETH

of the tangential load, it will be assumed that it will be applied midway between the points *a* and *b* on tooth *2*, or at the point *c*. By measurement we find that for this particular ratio, the point *c* strikes the involute tooth curve at a distance down from the point of the tooth equal to about ⅔ of the addendum. In determining the strength of the tooth, this point determines the location of the point of application of the tangential tooth

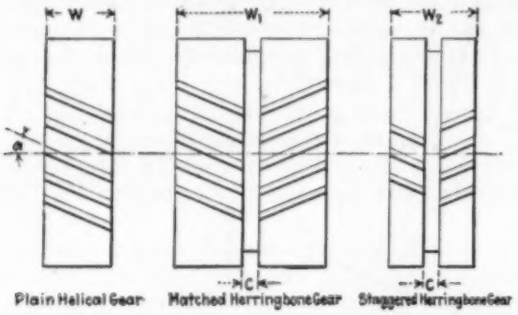


FIG. 7—"PATH OF CONTACT" OF HELICAL GEAR TEETH IN TWO POSITIONS; ALSO METHOD OF OBTAINING STRENGTH FACTOR

load. In order therefore to determine the weakest section of the tooth, we would construct a diagram, such as is shown at *C* in Fig. 7, and determine the value of *X* by calculation, as will be explained later.

The greatest load on a helical tooth is carried on a plane at right angles to the normal section of the tooth, so that in order to determine the strength of the tooth, it is necessary to find the proportions of the tooth on the normal section. Fig. 8 gives the necessary information to determine the shape of the tooth on the normal plane. To take a practical example, assume the following:—That the gear has 15 teeth, ¾ pitch, 20 deg. stub tooth, and a helix angle of 23 deg. 25 min. The proportions of the teeth on the normal and diametral planes are as follows:—

Diametral Plane

Number of teeth = 15
Diametral pitch = ¾
Pitch diameter = 2.1428 in.
Pressure angle = 20 deg.
Tooth thickness = 0.2244 in.

Normal Plane

Number of teeth, $N_1 = \frac{N}{\cos^3 a} = \frac{15}{0.7727} = 19.4125$

Diametral pitch, $P_1 = \frac{P}{\cos a} = \frac{7}{0.91764} = \frac{7.6283}{9}$

Pitch Diameter, $D_1 = \frac{N_1}{P_1} = \frac{19.4125}{7.6283} = 2.5448$ in.

Tooth thickness, $T_1 = \frac{1.5708}{P_1} = \frac{1.5708}{7.6283} = 0.2059$ in.

Tan of pressure angle, β = tan 20 deg. × cos 23 deg. 25 min. = 18 deg. 28 min.

in which

N = number of teeth on diametral plane
N_1 = number of teeth on normal plane
P = diametral pitch
P_1 = normal diametral pitch
D = pitch diameter
D_1 = normal pitch diameter
T = tooth thickness
T_1 = normal tooth thickness
a = pressure angle
β = normal pressure angle

We see from Fig. 8 that on the normal plane, the gear is of elliptical shape, but in order to determine the strength of the tooth, we ignore the ellipse and consider the tooth simply as though it were laid out with a larger pitch diameter, greater number of teeth, and a smaller pressure angle. The result or strength factor *X* at *C* in Fig. 7 was calculated by drawing a tooth to the dimensions given for the normal plane.

From the foregoing remarks it will be seen that the helix angle of the tooth affects its strength. There are two reasons for this effect. In the first place, an increase in the helix angle, increases the tangential tooth load, and in the second place, it reduces the thickness of the tooth on the normal section. The following

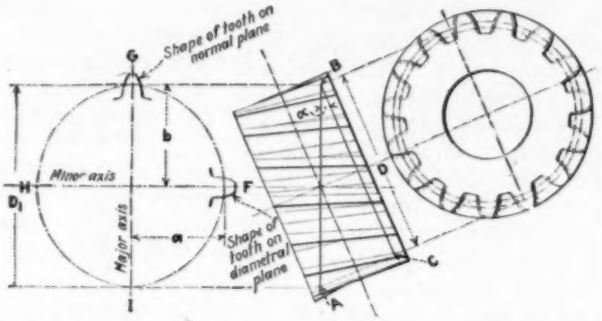


FIG. 8—DIAGRAM SHOWING DERIVATION OF FORMULAS FOR OBTAINING THE NUMBER OF TEETH ON THE NORMAL PLANE, AND OTHER NORMAL TOOTH ELEMENTS OF HELICAL GEARS

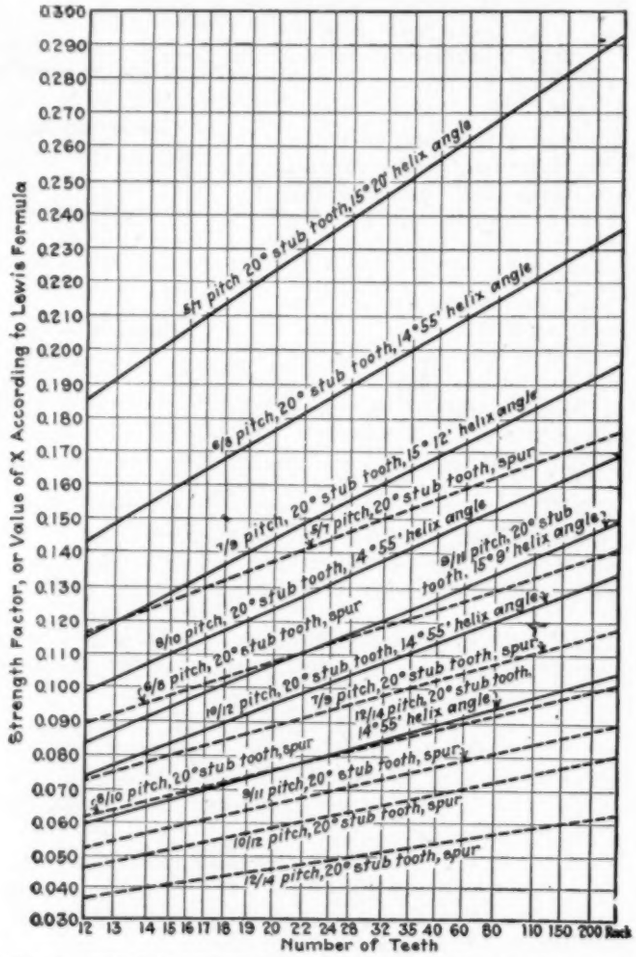


FIG. 9—COMPARATIVE STRENGTH VALUES OF SPUR AND HELICAL STUB-TOOTH GEARS

examples serve to illustrate these points: We will compare a 15-tooth spur pinion of ½-pitch with a helical pinion having the same number of teeth and pressure angle, but having a helix angle of 15 deg. 12 min. According to the Lewis formula, the strength factor X for a spur tooth of this pitch, number of teeth and

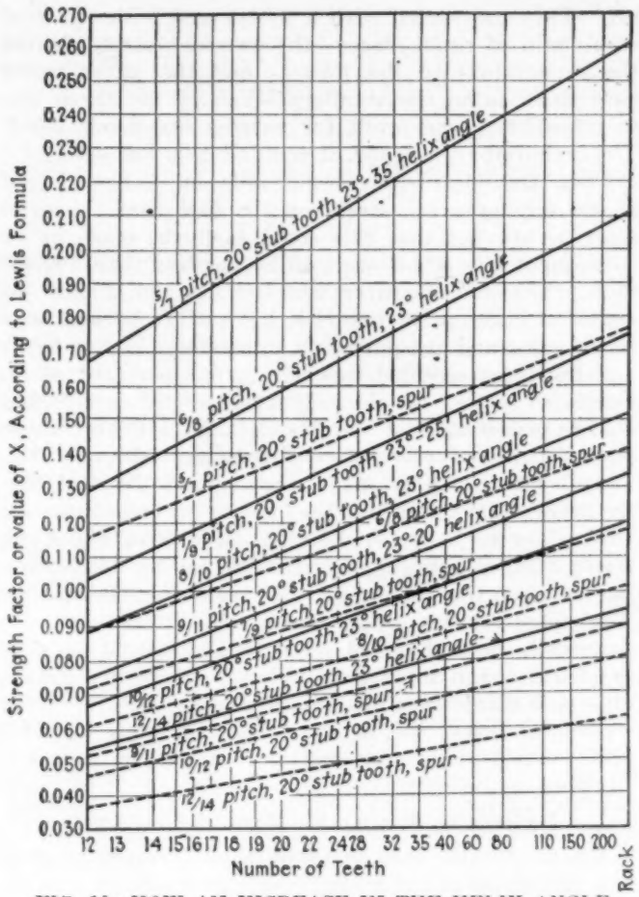


FIG. 10—HOW AN INCREASE IN THE HELIX ANGLE DECREASES THE STRENGTH OF THE TOOTH

20-deg. pressure angle, is 0.0794, and for a helical gear of the same pitch, and having a helix angle of 15 deg. 12 min., X is equal to 0.128. It is therefore stronger than a spur tooth, but as will be explained later, the increased strength is reduced when the helix angle is increased.

A comparison of a 15-tooth pinion having a helix angle of 15 deg. 12 min. and another pinion having a helix angle of 23 deg. 25 min. shows that there is a considerable reduction in strength due to the increased helix angle. The value of X for the first pinion is 0.128, and for the other is 0.116, a loss in strength value of approximately 10 per cent. But that is not all, the tangential tooth load has been increased 5 per cent, thus making the effective strength of the tooth that much less. Figs. 9 and 10 give a comparison of spur and helical stub-tooth gears having various pressure angles. The value of X can be used directly in calculating the strength of the teeth, and the manner of application will be presented later.

New Standard Steel Sample

The distribution, with a provisional certificate, of standard sample No. 11c basic open heart 0.2 per cent carbon steel, was commenced during the past month by the Bureau of Standards, Washington, D. C.

Poor Business Policy

BY DONALD A. HAMPSON

IN THAT machine shop classic, "Extracts From Chordal's Letters," we read of a patentee who gave an order for three sample machines to both Wycoff's and Sackett's shops with no stipulations as to price, his object being to secure samples of their work and to ultimately ask for bids on large quantities, based upon the experience gained in actually building the machines and thus learning those little kinks which always show up to add to the cost of any job.

That principle is the correct one, as true today as when written in 1880, but we seldom run up against such a patentee in these days. Today, he wants a price on the first machine, estimated from more or less incomplete drawings, and wants that price to be rock bottom. No inventor can ever see that there will be any hitch in his device's working, he cannot realize that there are always "bugs" to be worked out, and he cannot conceive the possibility of any change in design proving advisable from the experience gained in making the first one. For these reasons, he wants to pay a price that about covers machining on parts; that looks all right to him because he knows that by putting in a few screws and adding a couple of raps with a hammer, the whole thing will go together and, presto, it will run.

ALLOWANCE FOR CONTINGENCIES

But you in the shop are more conservative—you know there is going to be time eaten up in experimental and assembling work and that the inventor is apt to ring in some minor attachments that "of course go with the machine" but which did not show on the sketches. You hesitate to take the job at such a low price but Mr. Patentee-Inventor hastens to apply the clincher to the bargain. He is going to want a thousand made up just as soon as he gets around to see a few jobbers and the shop that stands by him on this first machine, why, they naturally will get the work if they can turn it out as cheaply as anyone else. The shop man falls for this—he loses on the first machine, as he was sure he would—and the inventor never comes after his thousand (in fact, never has a second one made) so the chance to recoup is gone.

Now, lack of business foresight and courage has sent more shops to the wall than mechanical mistakes ever did. This thing must be stressed again and again, as businesses change hands with the years. It is more important than the best methods in the shop itself. Hundreds of shops and thousands of mechanics are depending for a livelihood on a sound business policy—shops of from two to a hundred men—and these are the ones that are the most frequent victims of profiteering in promises. The bigger shops that cater to special work will not quote a price on an experimental job, or if they do it is miles high for protection, and they require an initial deposit, bills paid weekly, and time enough to bring the device to a state of perfection.

The books of small shops are thickly sprinkled with these losses and written off accounts. They don't all come from inventors; many of them are jobs taken on for good customers—jobs sent in along with other work, accepted as a matter of course, finished up, and billed at less than time rates. Very often these jobs take an unusual amount of time. You say they don't show

for it and you chuck off ten or twelve hours because you don't want to sting the Blank Co. Many of these jobs from "good customers" should go to specialty plants where the work could be done at a profit because of special equipment.

Near us is a foundry and machine shop that builds conveying machinery in a moderate way and has good equipment for general work. During the recent dullness, it solicited work far and wide and among the new customers was a concern that re-faces wooden stairways and covers them with cast iron treads or grill plates. In order to secure other business from this firm, the foundry undertook to cast 14 tons of these plates. It has no pattern shop and so brought the prints to us to figure on.

Details on Which to Base an Estimate

All of the plates had a ½-in. floor on which was built the grill work, consisting of 1-in. squares made of strips ¼ in. high and ⅛ in. thick at the base, tapered off to ⅛ in. at the top. The plates were six to eight inches wide and in lengths from two to nine feet. We figured carefully, knowing what the foundry was going to charge per pound for the iron, and came to the conclusion that the cost would be prohibitive—such frail patterns, so many thousand little cross pieces to set. We refused the job.

Later, we did cut out the strips for the patterns on a time basis. The shop's handy man worked months on the patterns, off and on, and the castings were finally delivered. But they would have lost money if they had charged 30 cents a pound. The patterns cost as much as had been expected both patterns and castings would cost. Castings by the hundred were spoiled, many that were crooked were shipped, taking a chance. Before this general foundry could make such delicate castings it was necessary to add thickness throughout the entire section. Poor judgment on the part of the men who designed such work, poor judgment on the shop's part in taking such a job, knowing almost to a certainty that it would lose on it but hoping to make up on other work.

Our plant has a department devoted to printers' work. Recently, Doubleday, Page & Co. asked for bids on some "bearers." The specifications were amply plain and stated the degree of accuracy and delivery requirements. Half a dozen manufacturers in that line submitted offers. Each knowing that there was competitive bidding, made the price as low as possible without having to sacrifice a reasonable profit and deliver a product that experience told would not be satisfactory. Our price was $1,370, and it has since been learned that was within $50 either way of all the others.

None of the specialists got the job. It went to a moderate sized plant in Brooklyn for $950. We knew our methods were good, we knew we could not supply these 1,400 pieces for less in any way except by cutting off all the profit which we, and everyone else in business, is entitled to, and sacrificing something in quality. We would not do this because the purpose for which these pieces are used calls for good pieces only. Therefore we awaited developments with interest, for we knew that we would hear sooner or later whether the machine shop had got stuck on the job, or whether the customer had received goods of inferior quality. And the word has just come along that the machine shop did a first class job but lost heavily on it—lost more than $420, you may be sure. And it all came through accepting work under duress, under the spell of a buyer's words.

An instance of the value of sticking to a fair price on the first job, regardless of future orders, may be recorded in connection with a carburetor job. An inventor back in the woods got up this carburetor and interested a business friend to help put it on the market. They contracted with a jobber and with the head of a chain of retail stores—the owners were to deliver the carburetors to the jobbers and the latter would pass them on to the retailers—each of the three was to get a handsome profit for passing the goods along. The carburetor was good, it couldn't help but sell.

Then the joint owners got bids on a first lot of 25,000, laying great stress on the fact that the price must be low but that this could easily be made up on subsequent lots which were to be not less than 100,000 each. The manufacturer who got the job finally accepted a lower price than his bid—BUT, he was wise to the game and had purposely submitted a higher figure and the price accepted was within one per cent of his estimated price, which had included the entire tool charge placed against the first lot and a liberal allowance for manufacturing contingencies. Actually this (wise) manufacturer made more out of the deal than the other conspirators for they got to quarrelling among themselves as to proper distribution of profits and this strife delayed retailing so that the selling season was passed when they finally got carburetors on the counter. The manufacturer really came out better than even, for, while he had tooled up with another lot in view, his fixtures and small tools followed the shop's general style and many were available for other jobs.

Besides price, the delivery question pops up after the work is under way and it is often the source of big loss to the shop.

Deliveries Should Be Made in Sequence

On a quantity job, the shop should refuse to make any deliveries out of order. All customers get anxious and want a few samples or have a selected list of prospects to whom they wish to demonstrate. They never thought of this possibility when placing the order and they cannot see how it adds anything to the cost of manufacture.

An instance of this and I am through. We had a contract for several thousand auto parts from an inventor who had a small shop of his own. We were turning them out in specified quantities but suddenly the inventor wanted them faster and finally submitted a proposition to do the assembling himself. This was agreeable to us, as we found the final adjustments, etc., were taking more time than we had anticipated and by taking this work off our hands at the inventor's price, we actually saved money. Our friend thought that we were spending too much time on this work, thus making the price to him too high and slowing deliveries. A year later he told us how he had lost by the deal—work that he thought he could do for three cents (we had allowed five) he found cost him six and a half cents with his own labor.

Summing up; let it be repeated to use your best judgment. Do not be persuaded by what a customer "knows" about production. Do not take one job in the hope of getting another. Do not make prices and delivery promises that you feel sure will cause trouble. There is no excuse for wearing out machinery and clogging your books with unprofitable work.

How Labor Can Be Made More Productive

By HAROLD C. SMITH
President, Illinois Tool Works, Chicago

Educational activities of the National Metal Trades Association —Five plans for training workers—Basic principles of training the same in all industry—Purpose of industrial training

FOR many years, the National Metal Trades Association has taken an active interest in industrial training. One of its early efforts was at the Winona Technical Institute at Indianapolis where the association, in conjunction with its Indianapolis members, completely equipped a machine shop and voted financial support to the institution for its maintenance, and a committee was appointed to co-operate with the officers of the institute. Later, when the school system of Indianapolis took over this institute and started the present Arsenal Technical High Schools, the equipment was transferred to it as a nucleus at that school from which the present extensive system of shops for vocational and technical education has grown.

As far back as the year 1906, in co-operation with the University of Cincinnati, under the direction of Prof. Herman Schneider, members of our Association opened their shops to students in the University's Co-operative Course in Engineering and this arrangement is still continuing. As a result, facilities are open to young men to acquire a practical shop training with an engineering education.

The year 1911 found the association actively supporting the efforts of the National Association for the Promotion of Industrial Education in working for the passage of the Smith-Hughes bill granting federal aid for vocational education.

A great impetus was given this work among our members as the direct results of the address entitled "An Abundance of Efficient, Well Paid Labor—How to Get It," delivered by H. E. Miles, Chairman of the Section on Industrial Training for the War Emergency, Advisory Commission, Council of National Defense, at our nineteenth annual convention which was held during April, 1918. A demand arose among those present for a systematic campaign to further intensive industrial training. Accordingly, a committee was appointed for this purpose, the basic idea being to interest a greater number of men in the machine industry and to increase the efficiency of those already in it, wherever this seemed necessary. Our present Department of Industrial Education has grown from these beginnings.

Address before convention of National Association of Manufacturers, New York, May 14.

> WITH something like 700,000 children annually leaving school at about the seventh grade, and the discipline and the teaching of practical things of life diminishing day by day, it is inevitable that a great responsibility for the real education of the mass of people in this country lies with the business corporation. Frequent complaints are heard that the workman of today lacks respect for property. I believe the remedy for this lies with ourselves.

While the signing of the armistice seemed for the moment to obscure the urgent need for intensive training, it soon became evident that industry could not afford to ignore the continued need for it in the competitive days of peace. This was amply confirmed when the committee made a tour to inspect the plans of a number of representative members. It soon became evident that to make real progress, it would be unwise to rely solely upon the efforts of the individual members of the committee, who could devote only a small portion of time to a subject which demanded a trained specialist, and therefore they unanimously recommended to the executive committee that the responsibility for carrying on this work should be placed upon a man especially qualified to undertake it, whose duty, among others, would be to call upon the individual members and make a study of the individual plants as a preliminary to offering recommendations for the introduction of some system of training. This recommendation was acted upon immediately and in July, 1919, Philip C. Molter was appointed superintendent of the department of industrial education and he has carried on the work since that time.

In the course of its studies, the committee found that the training of workers is now being carried on under five general plans, each with its place in industry.

The field man, depending upon the conditions found at the plant under investigation, recommends one of these five plans, and in some instances, a combination of several of them. These five plans may be designated as follows:

Instruction by Foreman.
Co-operative and Continuation Schools.
Special Training in Plant.
Vestibule Schools.
Apprenticeship.

It may be advisable to summarize the details of the above

Instruction by Foremen.—This is the system most universally employed and consists of putting the workmen directly into the department, under the supervision of the foreman in charge, who is entirely responsible for their success or failure. Our committee finds that

the particular objection to this method is that the foreman, being responsible for the output of his department, has in many instances neither the time nor the patience to properly instruct the worker, and in many cases lacks the ability to impart his knowledge. Also, that lack of sympathy with the training idea or even personal prejudice may militate against thorough instruction, the result being low efficiency and loss to both the employer and the workman.

The Co-operative and Continuation Schools have for their object the manual and technical training of boys and young men in a particular craft or trade which they may select. By this form of education the boy is able to earn money throughout his school course, and is enabled to obtain an education, whereas without such an opportunity many would be compelled to quit school entirely. It has an advantage in that it requires no additional expenditure or teaching force, with the exception of one supervisor to aid in co-ordinating the efforts of the industries and the public schools.

Compulsory attendance at continuation schools by permit workers has also made rapid strides, the majority of states now having legislation making this form of education mandatory. Our committee feels that these forms of education are desirable and most earnestly asks the interest of manufacturers in such schools in order that they may be made most practicable and kept free from political influence. Of course, these schools being under public supervision, cannot be expected to convey confidence in the intentions and policies of any particular company. This is the responsibility of the management of the plant itself, and, *provided those who govern industry can be awakened to their duties*, this important step will not be overlooked.

Special Training in Plant.—This system, which consists of training in the department by a general instructor, has some of the advantages of the vestibule school and, in our opinion, is preferable to instruction by foremen. It is particularly applicable in shops whose equipment consists mostly of large tools which cannot be isolated.

Vestibule School.—This plan came into prominence during the war. As the name implies, it is intended as the worker's entrance to the factory. While by no means supplanting apprenticeship, it is adaptable in some form in most shops, and properly managed, goes far toward relieving the shortage of skilled labor. It has been applied very successfully to the intensive training of workers for repetition processes and has also been used to train specialists. Where this form of training is used, all accepted applicants are sent to the school, where their fitness or unfitness is readily determined. The length of time to be spent in the school depends upon the skill of the applicant, his adaptability, and the character of the work he is to be taught. Our committee finds that the training time varies from three days to three months.

Apprenticeship.—Apprenticeship is particularly designed to take care of young men who wish to learn a trade in all its branches, but is not generally adaptable to the instruction and upgrading of unskilled workers. Our committee finds that while there has been a lull in apprenticeship training, partially as a result of conditions brought about by the war, this has been due also in a large measure to the unattractive conditions of the indentures. To remedy this, the committee developed plans for apprentice training which were submitted to, and adopted as basic practice by the National Metal Trades Association at the annual convention of 1922. We believe this plan, wherever installed, is sufficiently attractive to secure and hold desirable boys and young men. The details of the plan can be found in our manual, "Apprenticeship in the Metal Trades," which is now in its third edition, due to the demand for copies both from members and from non-members, public school authorities and educators generally. It is worthy of mention that the National Metal Trades Association was the pioneer in this country in the work of industrial training in an organized and practical way as an association project, our officers having realized that the duty of furnishing proper industrial education, and along with it the necessary collateral studies for young people, will devolve sooner or later upon industry itself. I am glad to say that today there are several other associations undertaking a similar work. It is the belief of the committee that in the majority of instances, shops with one hundred or more employees should consider seriously the establishment of a training department.

No One System Recommended for All Plants

While the individual members of our committee have a preference for certain methods of training within their own establishments, the committee as a whole has not reached the point where it recommends any one system of training as applicable to all plants. In view of the size of our membership, the differing production methods, the vast territory covered, and the changing conditions in industry, the futility of recommending any one system can readily be seen.

The following observations, we believe, generally apply:

Comparatively few men have the faculty to impart knowledge to others. Often the best workman is the poorest instructor. Hence it is preferable in most cases to engage a competent man to assume this work.

Even though the foreman happens to be a good teacher, he is in most instances too occupied with important production problems to devote proper attention to beginners.

The average foreman, due probably to the press of other matters, lacks the necessary patience, and sometimes the human insight, for instructing the beginner. He may also consider himself too high grade an executive to be assigned to such work.

Unless the schooling is centralized, the company cannot readily carry out a fixed policy with regard to teaching subjects pertaining to honesty of product, citizenship, pride in good workmanship, and loyalty.

The influence on the future attitude of learners toward each other and toward industry depends largely on the impression made on them at the start. This should be borne in mind constantly.

In a school, the beginner is sure of a variety of work, whereas the tendency in the shop is to give him such a quantity of simple work that he will not need the attention of the foreman for some time.

Each plant should be considered individually, bearing in mind the product manufactured, the varying degrees of skill and intelligence required, the number of workers employed, the plant organization, the labor turnover, the method of recruiting new workers, the system, if any, of training already in use, the prevailing wage plans, the plant spirit, local conditions, as well as other factors having a direct bearing on the question of training and education for the individual plant.

It was even found necessary, by way of a preliminary step, to carry on a campaign of education to impress upon plant owners and executives the value of, and need

for, industrial training. A series of bulletins especially prepared, was sent to all members, and naturally created considerable interest in the subject. For a time our department of industrial education was occupied in replying to the various questions which came from interested people.

It may be well to point out here that while the primary objective is to develop manual dexterity in the work, too much stress cannot be laid upon the need for supplementing this by a common-sense education, as well as to convey to the worker the real policy of the employer. This latter must be done by the employer himself or by his authorized representative.

With something like 700,000 children annually leaving school at about the seventh grade, and the discipline and the teaching of practical things of life diminishing day by day, it is inevitable that a great responsibility for the real education of the mass of people in this country lies with the business corporation. Frequent complaints are heard that the workman of today lacks respect for property. I believe the remedy for this lies with ourselves along the lines just indicated.

As mentioned before, the field work of the committee is carried on by a specialist on industrial education who was chosen because of a combination of broad, practical shop experience, technical education and teaching ability. The work was started by sending the field man to a given branch of the association where he would remain until all the members in that district were visited, the ideas of the committee explained and surveys made and recommendations given to those who showed any interest in the proposition, with the result that here and there some type of training would be given a trial. These early efforts were distinctly of a pioneering and missionary nature, as it was necessary to overcome the inertia which usually opposes the adoption of a new idea or a new method of procedure. Those of our members who adopted some definite method of training soon became enthusiastic about the results and the story of accomplishment spread.

Training Now Resumed

As might be expected, when the depression in business occurred, training activities were temporarily halted, but I am glad to say that the majority of those so affected have resumed their training plans. Concrete evidence that this pioneering work has made definite headway is shown by the fact that many of the members' plants where visits and surveys were made, and where the matter was held in abeyance by the results which have been obtained in factories adopting a definite training method, worked out plans to meet their own requirements. In nearly every instance the plans have been submitted for consideration and whatever suggestions we made generally have been written into the final form.

To conserve time and travel, requests for service are now listed and the calls receive attention as soon as the itinerary of the field man will permit this to be done.

Before a recommendation regarding training methods is given to any member, the field man spends sufficient time in the plant to study its individual needs and to determine how a definite method of training may be introduced without disarranging or upsetting the existing methods of production and how the support of all concerned may best be obtained. We feel sure that this is absolutely necessary as the success of any plan depends largely upon the co-operation of those responsible for production with those responsible for instruction and training of the workers.

The department of industrial education is also in a position to guide those having training plans in operation. In addition, it acts as a clearing house for trained instructors and directors of education and training, although wherever possible to do so, it recommends that these be chosen from among the regular force. The department also aims to keep abreast of all developments in vocational and technical education, and to keep fully informed on legislation bearing on these subjects. From time to time, bulletins are issued to the members with a view toward keeping them informed on developments along these lines.

Manual on Apprenticeship

About a year ago the committee issued the manual, "Apprenticeship in the Metal Trades." This publication contains what we believe is the first national plan of apprentice training which, with slight modifications, can be adapted to plants of any size. Another book, "Elementary Machine Shop Practice," has just been completed and is now ready for distribution. This text was prepared by the committee to meet the urgent request from the membership for a simple manual to be used by first-year apprentices and beginners. Its primary purpose is to establish uniformity in a subject which heretofore has been left to individual effort.

Let me read from the foreword of this textbook:

"There is hardly any question but that the superior standard of living of the American worker is due largely to the fact that his individual output is correspondingly greater than that of the average worker of any other country, and it must follow that so long as this standard of production is sustained, the advantage of the American wage earner will continue; conversely, should restriction on ambition and upon the right of anyone to enter a chosen trade be enforced through artificial means, this advantage will be lost."

It is planned to issue further publications along similar lines from time to time, as necessity may require, with a view to filling what is believed to be a long-felt want.

The success which our own organization has had with this work is, I believe, the best possible proof of its value. Beginning in 1922, a request was made for a report on the question of training within the association. Replies from 59 per cent of the membership showed that 146 trained apprentices, 72 trained operators or specialists, and 68 trained foremen. This year a similar reply from about the same number of members showed an increase of 162 per cent in apprentice training, 378 per cent in specialist training, and 240 per cent in foreman training.

I see no reason why the basic principle of training as applied to industry should differ, whether you are operating a machine shop, a silk mill, a paper mill, a railroad or even a bank. It can be accepted as a general proposition that the factory with intelligently trained workers has lower production costs, which make possible lower selling costs with consequent increase of output and sales. In times of keen competition these elements are frequently deciding factors between profit and loss.

Intelligent training also makes possible sustained production on a schedule which permits a higher wage for the worker, adequate returns on the capital invested, and continued cordial relations between the employees and the management.

Necessarily, within such a brief space of time, it is

impossible to go as much into detail in sketching the training activities of our association as fully as one might desire. The outstanding feature of what the association has so far achieved in this work is especially important in the untold possibilities which it has already revealed. Perhaps the work already done will be like "the grain of mustard seed which a man took and cast into his garden and it waxed and grew into a great tree, and the birds of heaven lodged under the shadow of it."

There are a great many people in this country today who make their living by spreading the seeds of discontent where harmony should prevail and whose chief purpose is to teach the worker to demand more and more pay, giving less and less in return. The purpose of industrial training in the final analysis, as I see it, is to teach the worker how to earn more and to improve his own position in life. I have endeavored to give a brief outline of the training activities of our organization as well as a few observations of my own, based upon a careful study of what I believe is one of the most important industrial problems of the day. If I have succeeded in arousing your interest sufficiently to cause you to seek further facts, I shall feel that my time and yours has been well spent.

Lathe Breakdown Tests of Some Modern High-Speed Tool Steels

Technologic Paper No. 228 of the Bureau of Standards, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15c. a copy, is concerned with comparisons of performance of modern high-speed tool steels in "lathe breakdown tests."

The work described in this report dealt not only with tests in which the endurance of tools is measured under definite working conditions, but likewise with the limitations of this method of testing when applied to the purchase of steel. The modern steels are first classified according to chemical composition, and this division is made use of in discussing the results obtained.

Important features developed may be summarized as follows:

(1) Breakdown tests are not satisfactory as the basis of purchase for tool steels.

(2) While competitive comparisons of brands of nearly similar performance are not justified, owing to the qualitative nature of this type of test, relatively large differences may be ascertained with certainty, provided sufficient tools are tested and averages of at least two grinds are used in interpreting the results.

(3) In certain severe breakdown tests with roughing tools on 3 per cent nickel steel forgings fn which high frictional temperatures were developed, it was found that the performance of commercial low tungsten-high vanadium and cobalt steels was superior to that of the high tungsten-low vanadium type, as well as special steels containing about ¼ per cent uranium or ¾ per cent molybdenum. The average power consumption in all cases was practically the same so that this factor need not be introduced in comparisons which may be made on the basis of the endurance of the tools.

(4) Modification of test conditions, including small changes in tool angles but principally changes in the cutting speed more markedly affected the performance of steels containing cobalt or special elements, such as uranium or molybdenum, than the basic types, such as plain chromium-tungsten-vanadium steels.

(5) The relatively poor endurance of high tungsten steels under severe working conditions was not observed in more moderate tests which were made on the same test log with equal cutting speed and depth of cut, but with reduced speed and in which the frictional temperatures produced were not so high. Also, in these latter tests the performance of the cobalt steels was better than either the low or high-tungsten steels.

(6) Hardness determinations and examination of fractures indicate that the various types of commercial high speed steel show differences in behavior under heat treatment and in physical properties which probably are of importance under moderate working conditions and might counterbalance slight advantages in performance.

Aluminum Bronze Castings

By F. J. Decker

Aluminum bronze castings are coming into increased favor for automotive use due to their extremely high strength and ability to resist shock. While this alloy is comparatively difficult to machine due to its great hardness and toughness, it is to be recommended in spite of this drawback wherever its valuable properties of strength and shock resistance are desired.

The best mechanical properties are obtained in an alloy containing 8 per cent aluminum, 3½ per cent iron and the balance copper. The alloy in the "as cast" condition has the following physical properties:

Yield point, lb. per sq. in.	28,000
Ultimate strength, lb. per sq. in.	79,000
Elongation, per cent	45
Charpy impact, ft. lb.	35
Brinell hardness, 500 kg.	130
Scleroscope	30
Rockwell No.	73
Specific gravity	7.64
Modulus of elasticity	17,500,000

Iron very markedly raises the tensile strength and hardness, and decreases the elongation. The addition of 3 per cent of iron more than doubles the proportional limit of stress to deformation and raises the modulus appreciably. So the addition of 3 per cent iron to this alloy is highly beneficial to the mechanical properties. When 3 per cent iron is present aluminum in excess of 8 per cent decreases both the strength and the elongation. In general it is found that 8 per cent of aluminum is the ideal point.

With proper precautions as to melting practice, and with the same general methods of gating employed as for manganese bronze, the alloy can be quite readily and successfully cast. A maximum furnace temperature of 2,200 deg. F. with a pouring temperature of 2,000 deg. F. is the general practice for average castings. Considerable care should be exercised to prevent oxidation by keeping the melt covered with a liberal covering of charcoal at all times. Large gates and ample risers are necessary, while bottom pouring through a skim gate, which allows the metal to enter the mold with the least agitation possible, is desirable.

This alloy shows up very well in porosity tests and in the instances where leaks have occurred under pressure they were due to casting defects rather than an inherent quality in the metal. It is subject to heat treatment in much the same manner as low-carbon steel.

Repairing London's Omnibuses

BY I. WILLIAM CHUBB
European Editor, *American Machinist*

The second of three articles—Inspecting worn crankshafts, camshafts and connecting rods—Grinding and running-in crankshafts—Boring connecting rods

THE GENERAL scheme having been indicated, some details may be given regarding operations on the chassis. The chassis section is under the control of a production engineer who directs the efforts of a number of section engineers, together with a plant and an electrical engineer, the work of each of these sections being under the control of foremen, assistant foremen and finally, charge hands who supervise the necessary repairs and are responsible for the work on given details. All work is machined to standards, and each section controls its own work and completes it, to cut

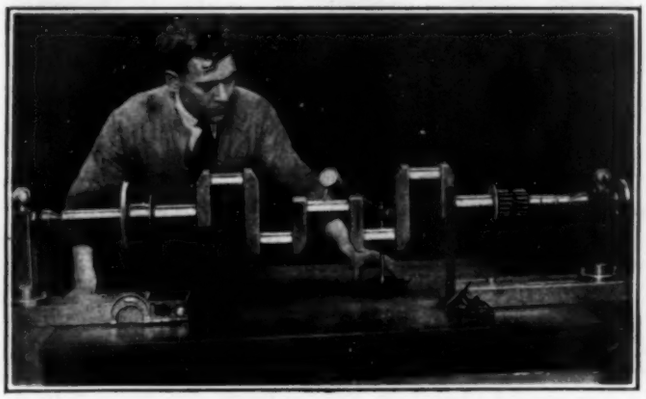


FIG. 6—TESTING CRANKSHAFTS

out inspection. For reporting progress, three control boards are installed in the chassis section, one relating to the platform float on which the complete chassis are built up. This board shows the hourly float of units of every type and the principal assemblies available for the erection of chassis as collected beside the traveling platform. The name of the unit is at the left-hand side of the board and pegs of different colors are employed to indicate the quantities in hand at a given time, the information necessary for keeping the board up to time being obtained by hourly census taken by the progress assistant concerned. Similarly the shops' output indicator shows hourly by pegs the aggregate output of all units and principal assemblies, the engineers and foremen thus being able to follow the progress of each section of the works, the progress assistant allotted to each section being responsible for recording the output which is summarized hourly. In addition, a third board shows the daily progress of units and assemblies due to the stores and to garages. It indicates the quantities of units of all types and principal assemblies that have to be overhauled and are due by way of the stores for distribution to the garages concerned.

Turning to engine parts, the crankshafts are first spun between centers to see whether they are bent, and this applies to the camshafts and to any other shafts that can be rotated. They are then tested as illustrated in Fig. 6 for twist and for size for grinding. As to the latter there are nine standards. The main journals are tested first for diameter and then the throws, the holes of the flange being tested by plug gage to size against excessive wear, and then the chain wheels are tested for wear.

For testing the alignment of connecting rods, the device used is shown in Fig. 7. At the big end, a cylindrical block at the base of the stand, is put in position, the reduced ends resting in V-blocks while the gudgeon-pin hole takes a cylindrical plug. The rod is rocked under the indicator, which has four bearing plugs and thus indicates twist in two directions at right angles.

The fixture shown in Fig. 8 will indicate wear at any point on the contour of the cam. The camshaft rests in two end bearings *A* and *B*, a sliding fixture *C* carries the pointer *D* and a vertical train of wheels drives an overhead splined shaft *E*. On the latter is a large disk *F*, on the face of which are engraved enlarged contours of four inlet and exhaust cams. Lever *G* bears at one end on the cam undergoing inspection and the movement of this end of the lever caused by the rotation of the cam is magnified five times at the other end. This movement gives a vertical motion to pointer *D* which thus travels across the face of the disk and, by

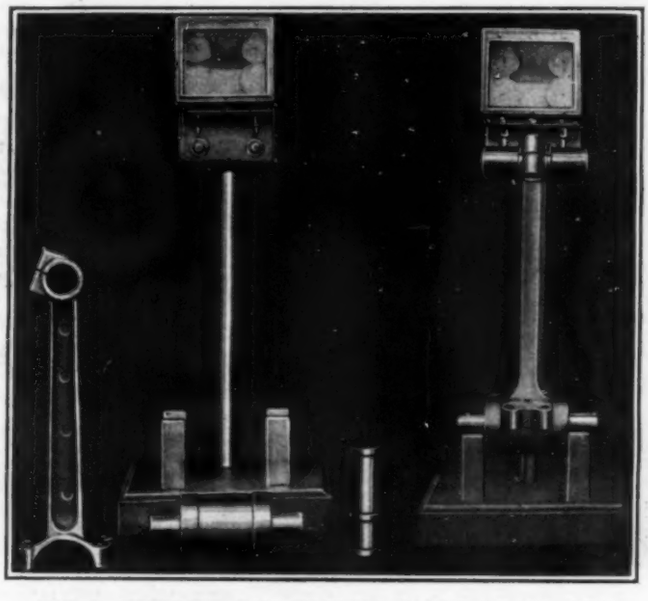


FIG. 7—FIXTURE FOR TESTING CONNECTING RODS

comparison with the path engraved, indicates the cam wear. The twist of the camshaft is also indicated by comparing the paths obtained with those already engraved. The limit of wear permitted, as shown by the indicator is 0.002 inch.

Grinding the crankshafts follows standard procedure in Landis machines. To avoid changing the heads, the grinding machines are arranged in blocks of three, one machine for the three main bearings and two machines which between them deal with the four throws. The nine standards for diameter range in steps of 0.02 in. to scrapping point. In grinding, the tolerance permitted is half a thousandth. The men work to micrometers and gages, the leading hands testing by master gages of caliper type. The output from the machines is 24 crankshafts a day. Fig. 9, which is intended to illustrate a block of grinding machines, is perhaps rather too crowded for that purpose but it shows pretty clearly at the left the stand used with each set of machines. The stand rotates and one of its four sides is kept supplied for the use of the first operator, who, on the completion of his operation on a given crank, places it on the second face of the stand which acts as a feeding point for the second operator, and so on.

For the production of the crankshaft bearings a gas-heated die-casting machine is employed, Fig. 10 illustrating the machine open, that is, with the head swung round through 90 deg. The molten metal is forced into the die by the manipulation of a handle. The die will be seen in place on the head. The bearings are produced at the rate of 60 to the hour by this machine and are in four sizes for each standard type of bus. Thus, for the latest type the range is from 51 to 54 mm. diameter; for another type of bus from 48 to 51 mm., and for an older bus from 43.5 to 48 millimeters.

In the final position on the stand, the cranks are ready for operation in the reaming and running-in machine, Fig. 11, to which the re-metaled crankcases are delivered. This special machine was designed at Chiswick and is double headed, one head being concerned with boring or reaming and the other with running-in. Between the two heads is a four-armed table giving four positions for the whole operation. In the first position the finished crankcase is taken off and another, previously ground on the horizontal joints, is located on the jig, being fastened at each end by a clamp. A bearing for the boring bar is provided at each end of the jig, while near the center is a steady-rest which can be opened to allow the cutter to pass. In the second operation the bearings are reamed to a

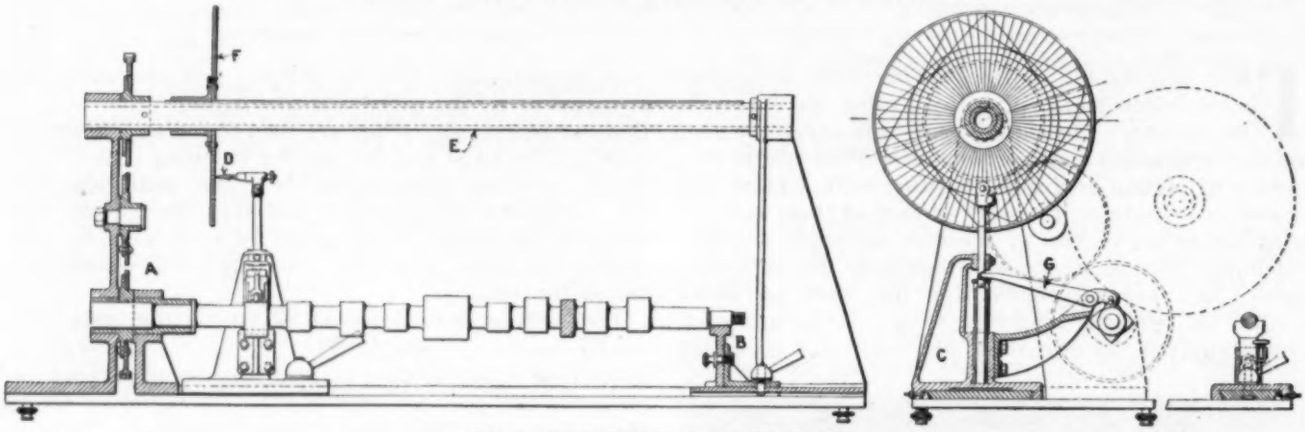


FIG. 8—CAM TESTING APPLIANCE

FIG. 9—CRANKSHAFT GRINDING SECTION

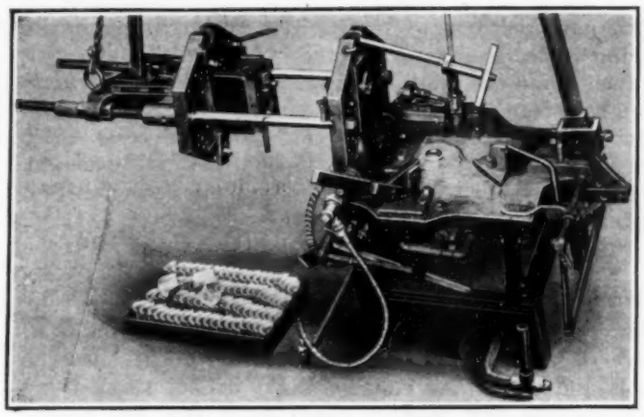


FIG. 10—DIE CASTING MACHINE FOR CRANKSHAFT BEARINGS

standard, depending on the crankshaft to be carried. In the third operation the main-bearing caps are removed, the crankshaft dropped in and the caps fastened on again. In the fourth operation the crankshaft is run in, the time for each operation being 20 min. In this time four men do the work which took one man two days when scraping the bearings by hand. The cutter shell is slipped on the bar, a recess at the

the boring bar at about mid position, is shown both open and closed in Fig. 12. A split bush carries the bar and is itself a sliding fit in the steady-rest bracket. Passing through and machining the central bearing of the crankcase, the cutter pushes the split bush through

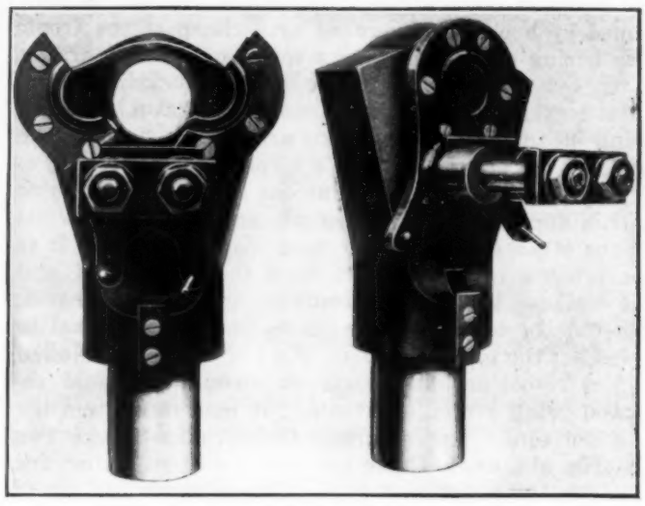


FIG. 12—CENTRAL STEADYREST FOR BORING BAR

FIG. 11—REAMING AND RUNNING-IN MACHINE

the bracket and when thus released the two ends open scissor-like, the tension spring, (not shown) effecting this movement. The cutter can therefore pass and the split bush is replaced in the bracket by hand. The whole steadyrest has to be removed before the crankshaft is put into place. The steadyrest registers in the jig and is fixed by a bolt through the top. In the reaming operation about 1 mm. is removed, leaving about one-thousandth for the running-in. The speed used is 200 r.p.m. and the feed 4½ in. per minute. For running-in, the crank is coupled to

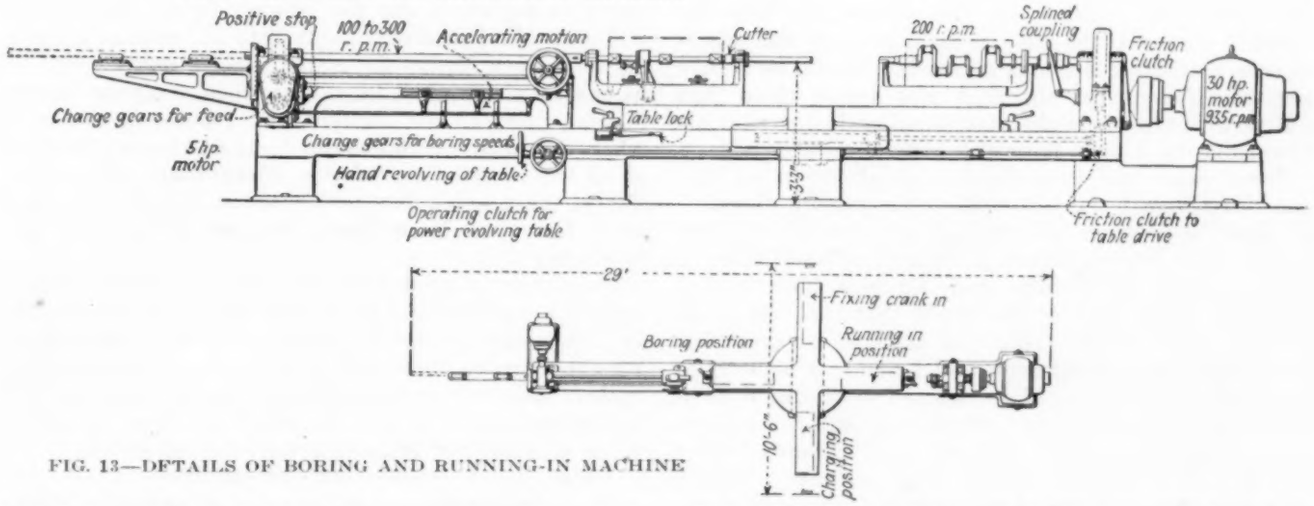


FIG. 13—DETAILS OF BORING AND RUNNING-IN MACHINE

back being used for driving by a cross pin. The cutter is drawn through the three main bearings of the crankcase, guided by the three steady bearings. For the idle time between bearings, the cutter feed can be speeded up mechanically, but the operator commonly moves the bar by hand. The automatic steadyrest which supports a 30-hp. motor and driven at 200 r.p.m., the bearings being fed with oil and gradually tightened. Satisfactory running is shown by the reading of the ammeter on the driving motor. The leading details of this machine can be gathered from Fig. 13.

The big ends of the connecting rods are bored on a

horizontal machine, the two heads of which, each with boring tool, are fed towards the center by a right- and left-hand screw in the bed. The central horizontal table is pivoted and carries four uprights, each for one connecting rod. At the top of each jig is a pin to represent the gudgeon pin and the lower end of the rod is positioned by a plug and secured by a clamp at the front. The boring cutters vary in a series of sizes according to the standard of the crank throw, as indicated by paint marks. The heads are run at 200 r.p.m., the feed being 40 to the in. Two rods are machined while the jigs for the other positions are being got ready.

The cylinder-boring machine has a four-position table with a duplex boring head at one end of the bed, while at the other end a lapping head may be added. It is the practice to finish direct from the boring tool, and the machine is timed to complete the work in 20 min. Where a bore is otherwise up to limits, it is usual to grind out the top ridge only. Wear of 0.01 in. is allowed before re-boring, the maximum amount of metal removed being ½ mm. on a side or 1 mm. total from the original size. For securing the cylinder blocks two fixtures are used, the other two positions being for cylinders of a different type. The cylinder casting is bolted to the face of the fixture, being brought to position by means of plug gages.

Sending the Expert Along

BY F. P. TERRY

SEVERAL contributions have appeared in the *American Machinist* recently dealing with the question, "Should the machine tool manufacturer follow up inquiries by sending along an expert, or simply quote a bedrock price and leave the customer to decide for himself on the take-it-or-leave-it principle?" Some writers prefer the latter method, and hold the view that the expert is an unnecessary waste of money which they are called upon to pay directly or indirectly. Writing from a long experience of purchasing machine tools, I have always upheld and appreciated a visit from the manufacturers' expert, providing he is of the right kind. I think that the writers who hold the opposite view are the ones in most need of the expert to enlarge their knowledge of machine tools, as I have generally found that the man who knows more than a little about them is the most anxious to increase his knowledge by a visit from the expert.

Some years ago I received a moral lesson on this question which I think is well worth passing along. I obtained a position as machine shop superintendent with a firm who specialized in what we will call blowers, having works in Britain and America, also branch offices in every part of the world that the "old man" thought worth while. This "old man" had a good deal to do with my appointment, and I admired his way of conducting business. If he wanted anything done it had to be done quickly, but should you want his decision on any point that didn't interest him, he would inform you that he was only acting in an advisory capacity as a chairman and would put you in touch with someone else, with the possibility that later on he would upset everything by becoming suddenly interested. Regarding the purchasing of machine tools, he always adopted with me his quick attitude, and I soon had $10,000 worth of new machine tools to assist me in getting out blowers. In addition to purchasing these I was also responsible for the item known as manufacturing costs, and naturally the "old man's" numerous branches and the sending along of a highly paid draftsman salesman to follow up an enquiry for a $40 blower "got my goat," and at one conference on costs I let everyone know, the "old man" included, what I thought about the whole business. The "old man" allowed me to finish, and then said very quietly:

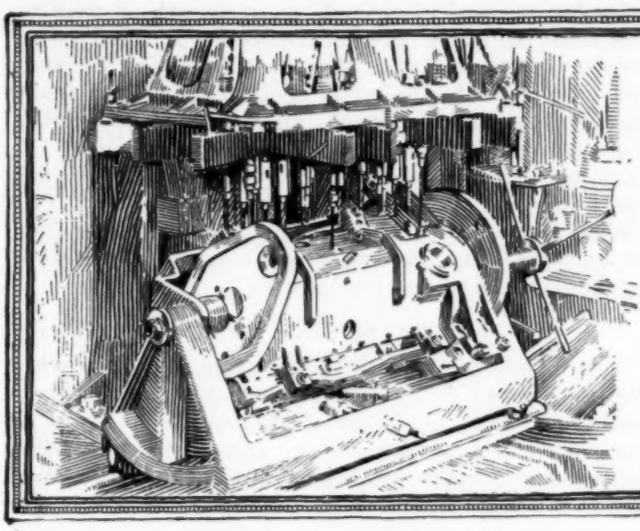
THE PROPER WAY OF BUYING OR SELLING

"Terry, you have done wonders in producing our blowers; you have cut costs enormously; you read advertisements and study everything about machine tools and what they will do, and I do not think there is a man in this country could equal you, but if you got ten yards away from a machine shop you would be lost. You have bought thousands of dollars worth of machine tools for us, all highly satisfactory, but you know nothing about buying or selling in its proper sense. I have directly bought only one machine tool in my life, and it's that little twist drill grinding machine that I see you've tucked away in a corner of the toolroom, but that transaction taught me something that you don't know. When I was establishing my American business, my partner and his lawyer came over here to settle up matters which had been left over when I visited them. On their arrival they had a friend with them making a sort of a holiday of the trip.

"When I was taking the whole party through the machine shop, this friend pulled out a picture of a new twist drill grinding machine he had brought out, and told me it was the very thing I wanted. I asked him the price, and he informed me that it was $240. I replied that there did not appear very much in it for all that, and he at once retorted, 'I am not selling the machine for "what is in it" but for "what you will get out of it."' Terry, I bought that machine and I have been selling my blowers on the same lines ever since. You object to me sending along an expert to sell a $40 blower, but, in fact, he really goes to see if the prospective customer is going to get more out of it than he puts in. If he cannot, we do not sell; if he can, we fix him up, knowing full well that he will never go anywhere else for blowers in the future, and will also talk a good deal about it to our mutual benefit. If we draw a blank, our man's time is not wasted, as he makes a day of it by calling upon everyone in the district that can use blowers, and I know of one case where following up an enquiry for a $40 blower brought along two installations of over $5,000 each. Of course, Terry, there are a few people using blowers who buy them for 'what is in them,' but our competitors can look after them."

There was a good deal more in this lecture, but I am quite sure the "old man" was right, and the fortune he left behind proved it. Ever since that time I have bought machine tools with a different perspective altogether, and, as I had proved years before that the well advertised machine was the cheapest from a money point of view, my education was well advanced.

Today, when considering the purchase of machine tools, I first study the advertisement carefully before sending along the inquiry, after which I am delighted to meet the expert for further information as to "what we will get out of it." Price is only a secondary condition, and so long as a prospective customer does not ask for an expert in the case of repeat orders, this method is, I am sure, the best.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of working gages continued—Gaging of gear teeth—Templet gages—Gaging shoulder distances and flanges—Application of flush-pin gages

IT IS occasionally difficult to draw a definite line to separate work and inspection gages, as the two types overlap each other to some extent on certain kinds of work. In the gaging of spur and bevel gears, for example, the gages used during the machining of the work are in some cases closely affiliated with those later used for the final inspection. The gaging of gears and gear tooth shapes is one of the most important matters with which the tool engineer comes in contact. A clear understanding must therefore be reached as to the reasons why certain gear dimensions and shapes are of importance. To those of us who can look back twenty years or so and remember the "grinding and howling" gears frequently heard on the streets as automobiles of that day labored along, the quiet running mechanisms of the present day reveal the amount of study and experiment which has done so much to improve the situation. The improvements have been in more than one direction, and they apply not only to the process of machining but also to better methods of gaging.

Factors Entering into Gaging

In considering the important points connected with the manufacture and gaging of gears, the following items are of interest:

(1) The diameter of the gear blank, no matter whether it is a spur or bevel gear, is of great importance, because from it the depth of the tooth is determined, and consequently the pitch diameter. In gaging the diameter of a gear blank no principles are involved which have not previously been taken up; and it is therefore unnecessary to go into details in regard to the gaging of this portion of the work, as the only requirement is a snap gage of standard form.

(2) The shape of the teeth is a very important factor in a train of smooth running gears. The greatest care is taken in determining a correct tooth shape, and a number of methods have been tried out in order to make comparisons between the theoretical form and the actual form produced by the gear cutting machine. Under the heading of Inspection Gages we shall take up this matter more fully. During the machining of the work, the shape is usually determined by means of a templet of such form that it can be applied to the gear tooth and also between the teeth.

(3) The depth of the tooth must be properly gaged if accurate results are to be obtained. Although the depth in itself is for the purpose of clearance, it will be seen that the pitch line and depth go together, due to the shape of the cutter used in machining the tooth.

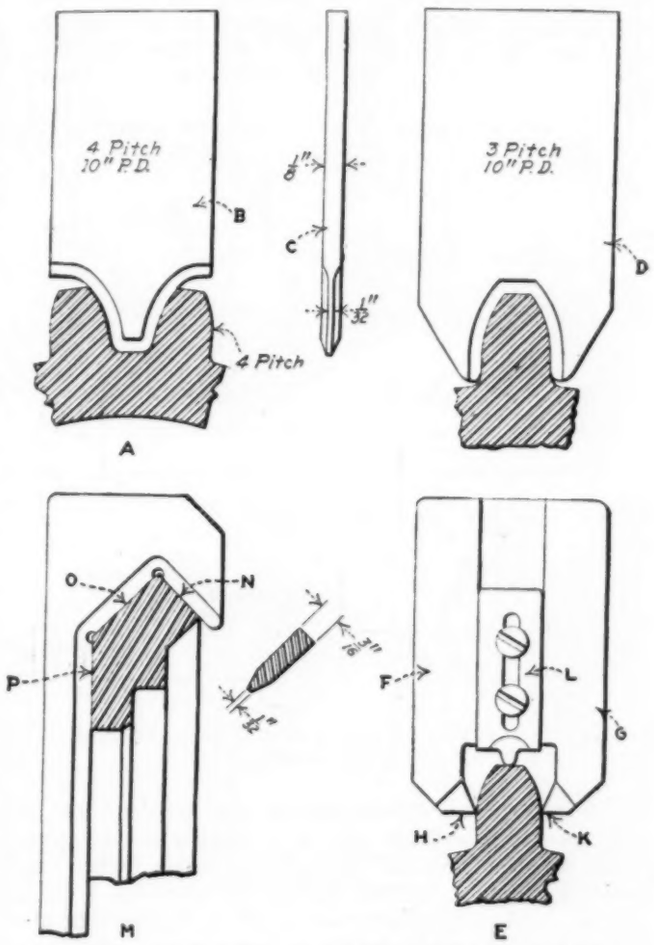


FIG. 535—APPLICATIONS OF GAGES TO SPUR AND BEVEL GEARS

For the authors' forthcoming book. All rights reserved.

Therefore, it is advisable to gage the depth of the tooth separately from the gaging of the pitch diameter.

(4) The thickness of the tooth at the pitch line is very carefully measured while the work is in process. Measurement is taken straight across the tooth at the pitch line, the position of which is determined from the outside of the blank. It will thus be understood that any deviation from the correct outside diameter of the blank will affect the gaging of the tooth thickness. The rolling action of gear teeth with each other is dependent very largely upon having the theoretically correct pitch circles, and at the point where the circles are tangent to each other the thickness of the tooth must be measured. After the gears have been machined, these points are carefully checked by inspection gages which we shall illustrate in another article.

(5) The diameter and concentricity of the pitch circle with the center of rotation are important points in the gaging of gears, but they cannot be determined except by an inspection system.

In addition to the points mentioned, the center distances at which various gears rotate, the alignment of the axes of rotation and some other matters are also of importance and will be taken up later. In the measurement of bevel gears, the angle of the teeth and the back angle must also be taken into consideration. It is very important to make sure that the sides of gear blanks, whether they are spur or bevel, are finished accurately in relation to the hole, in order that the gears may not be sprung out of truth after they have been assembled in the completed mechanism. Gears

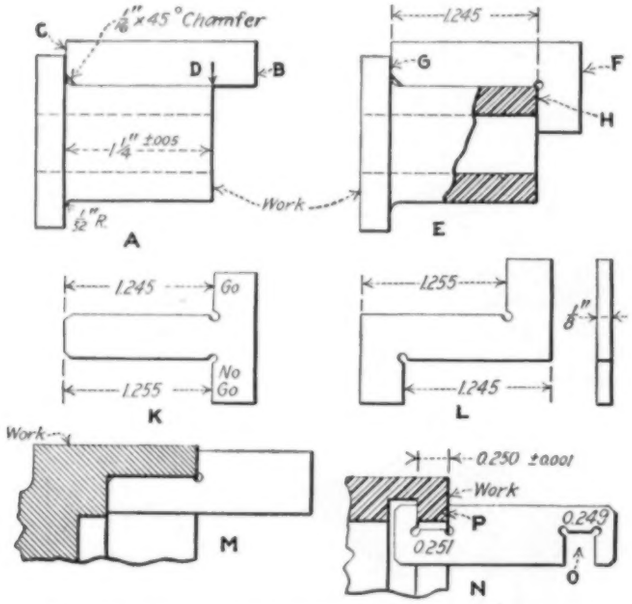


FIG. 536—TYPES OF TEMPLETS FOR SHOULDERS AND FLANGES

are frequently drawn up against the shoulder and if they are not true there will be a binding or cramping action in the finished mechanism. Also, when assembling on an arbor for machining purposes, trouble may be caused by inaccurate work in facing. In the case of bevel gears, the angular faces must also be carefully gaged with relation to the hole, but a simple form of gage can be used for this purpose which does not differ greatly from others previously described.

In Fig. 535 are shown several applications of gages to spur and bevel gears. In the example illustrated at *A* a templet form of gage is shown at *B* such as used to determine the shape between the teeth. If this type of templet is used as a work gage, it will show by its position in relation to the teeth whether or not the tooth has been cut deeply enough, provided that the cutter shape is correct. The templet is frequently made in knife edge form, as shown in the end view *C*, in order that a line contact may be obtained on the tooth. The workman holds the gear up to the light and determines the correctness of the contour by noting the variation between the tooth and the templet.

Gaging of Gear Teeth

The outside of the tooth is gaged in a similar manner, the templet being of the form shown at *D*. Any variations in the thickness of the tooth and errors in the contour will be apparent by noting the differences between the templet and the tooth. It must be understood that both these templet gages are for use in the factory when setting up the machine and starting

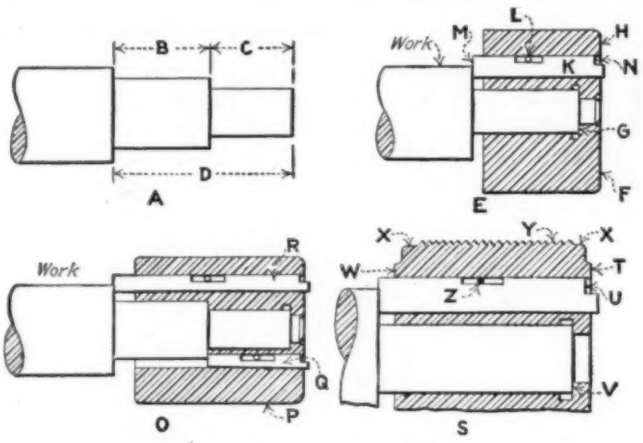


FIG. 537—PRINCIPLES OF SHOULDER GAGING AND THEIR APPLICATION

production. They also determine whether cutters are doing their work properly, or not.

The principles of a work gage which can be used to determine the thickness of the tooth and the relation of the pitch circle to the outside diameter of the blank, are shown at *E*. This device is a comparatively simple form of gage which uses the same principles as the micrometer gear-tooth caliper. The two members *F* and *G* are so arranged that they will measure the thickness of tooth at the pitch line at the points *H* and *K*. The depth is determined by a sliding member *L*, which is adjusted and set positively the correct distance from the outside of the blank to the pitch circle. This type of gage is of simple form, but refinements in the nature of adjustments can easily be provided if it seems desirable.

A templet form of gage used for determining the relation of the angles in a bevel gear is shown at *M*. The angular surfaces of the gear at *N* and at *O* bear a distinct relation to the back face *P*, so that by using the gage in the form shown any variations will be readily determined. It is seldom necessary to use gages of more intricate form than these when gaging gears previous to the inspection. It is understood, however, that such portions as the diameter of the hole, shoulder distances, thickness of flanges and depths are also gaged by the use of standard forms and types of gages.

Other matters in connection with the gaging of gears

will be described more fully under the heading of Inspection Gages.

In the gaging of shoulder distances and flanges a great deal depends upon the accuracy required in the work. When shoulders are to be kept within tolerances of 0.001 to 0.003 in., the gaging problem requires more careful consideration than if the tolerance is ± ¼ in. For the latter condition templet gages are often sufficient to fulfill the requirements, while in the more accurate work other forms must be devised. Fig. 536

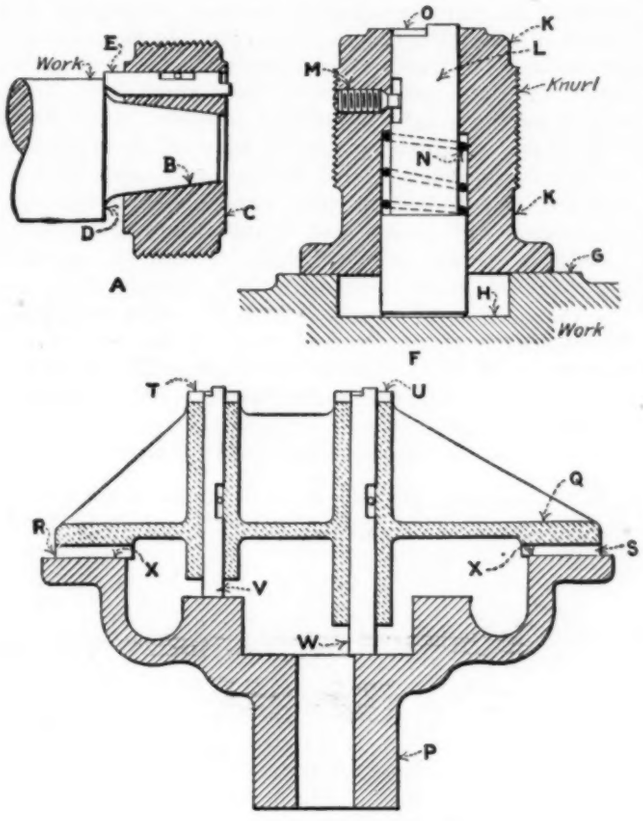


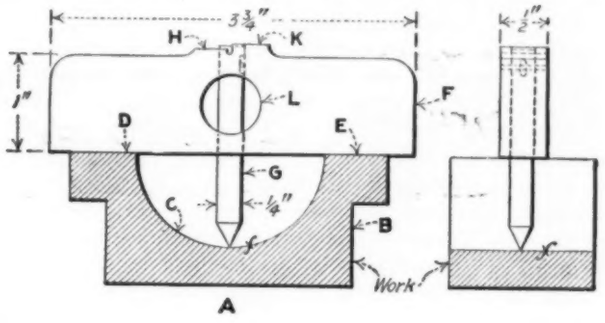
FIG. 538—FLUSH-PIN GAGES

shows the applications of several types of simple gages to shoulder work and flanges. The example shown at *A* is of the simplest variety, consisting only of a steel templet *B* squared up at the end *C* and having a line on it at *D* to indicate the length required.

In the example *E* a slight improvement is seen by carrying the end of the gage over as shown at *F*, instead of using a line as in the previous example. In using the latter type of gage the workman determines the length by noting whether the end *G* strikes the flange, leaving a space at *H*, or whether a contrary effect is produced. In the first case the operator will know that the shoulder distance is not long enough, while in the latter instance it will be evident that it is too long. The same principle can be applied with tolerances, if desired, by using a form like that shown at *K*. In this example a tolerance of 0.010 in. is provided for the go and no-go limits. Another form which gives the same effect is shown at *L*. There is no particular choice between these two types except the fancy of the designer.

In applying a templet form of gage to determine a given depth in a hole the form shown at *M* can be used in some cases, providing the tolerances are not too fine. In general, however, this type is not good for inside work, as the operator cannot see clearly the points that he is gaging and therefore there is a possibility of errors. In general principle this gage is the same as that shown at *E*, except that it is applied inside instead of outside. A type of snap gage for an inside flange is shown in the example at *N*. This is a limit gage having a slot at *O* and another at *P*, each of these slots being ground to the limits required. Gages of this sort are usually made from sheet metal ¼ in. thick and upwards, depending on the size and nature of the work.

When the tolerances on work are exacting and when the work itself consists of several shoulders which must bear a definite relation to each other, templet gages are not sufficiently accurate to meet the requirements. It should always be remembered by the designer, however, that accurate shoulder distances are difficult to machine, for which reason it is advisable to allow as much tolerance as possible in cases of this kind. Fig. 537 illustrates some of the principles used in shoulder gaging and their application. The example *A* is a steel shaft having two diameters which are to be machined at *B* and *C*. The distance *D* is important and it should be gaged from the end of the work. The distance *C* is also to be accurately made, while that at *B* depends on the other two dimensions. It is not usually advisable to attempt to gage depths from two different surfaces, and therefore any gages made to determine the distances *C* and *D* should be so arranged that they register from the same point. No attempt should be made to gage diameters with the same gage that is



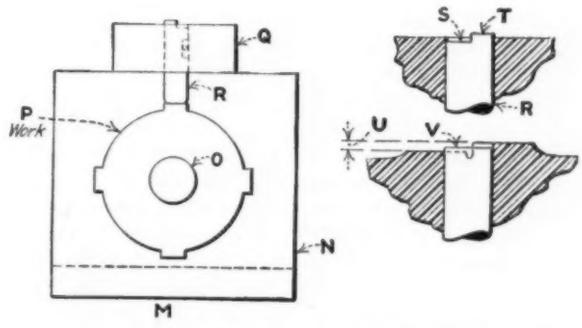


FIG. 539—OTHER APPLICATIONS OF FLUSH-PIN GAGES

used for determining shoulder distances. The diameters would be kept within limits by means of snap gages.

In the example *E* a single shoulder is to be gaged from the end of the work *G*. The body of the gage *F* is made of machine steel hardened, ground and lapped where necessary, and it is fitted with a pin *K* so placed that it strikes against the shoulder of the work. The pin is prevented from falling out of the gage by a retainer

L. One end of the pin *M* is ground flat while the other is relieved as shown at *N*. The amount of this relief is determined by the tolerance permitted on the work. In using this type of flush-pin gage the workman places it on the work until the portion *G* strikes the end of the shaft. He then pushes the flush-pin forward until the end *M* strikes the shoulder. By noting the position of the end of the pin in relation to the gage, he can determine whether the work is within the required limits or not.

Another application of the same form of gage to the gaging of two shoulders is shown at *O*. In this case the sleeve *P* slips over the end of the work as shown, and the two shoulders are gaged by noting the relation of the pins *Q* and *R* to the end of the gage.

Construction of Flush-Pin Gage

An enlarged view of a flush-pin gage is shown at *S* in order to bring out some of the important points. The gage sleeve is knurled at *Y*, the knurling is cut away at *X* and the corners nicely rounded or chamfered, and there is a relief at each end at *W* and *T*. These ends are ground square with the hole. The flush pin is relieved on the end at *U* and the two shoulders are ground perfectly square. The pin *Z* simply acts as a retainer to prevent the flush pin from coming out. The inside cylindrical portion and the end *V* must be ground and lapped to size. A little attention paid to detail in designing any type of gage is fully repaid by the workmanlike appearance of the finished product. It is an easy matter to determine the amount of gaging experience which a designer has had, by the appearance of the gages which he designs.

Several other applications of the flush pin to a gaging proposition are shown in Fig. 538. In the example *A* a difficult problem was encountered, as a shouldered tapered shaft was to be gaged. In order to prevent the piece which fits the taper from striking the shoulder before it has made positive contact with the taper, the shoulder must be gaged in relation to the taper. There is no particular difficulty in the design of the gage itself after the idea has once been worked out. The collar *C* is of steel, and it is made up to fit the taper portion *B*. The relation of the taper to the shoulder is determined by the position of the pin *E* and the amount of projection on the face of the gage. If the tapered portion of the work is too small, the collar will go on the taper further, and therefore the pin will protrude a greater distance beyond the face of the gage. If the tapered portion is too large the pin will not protrude at all, and thus will indicate that it is oversize. The general principles of this gage are exactly the same as those previously described.

A flush-pin type of gage is frequently used for determining depth, as shown in the example at *F*. In this illustration the body of the gage is made of steel and ground square so that it rests on the surface *G*. It is knurled on the outside and relieved at *K* to make an attractive finish and to avoid a ragged appearance. The pin *L* is cut away on the end in the usual manner to correspond with the amount of tolerance permitted. The end of the gage *O* is ground flat and square with the body. A retaining pin *M* is used to limit the action of the pin and a light spring *N* is used to keep the plug down on the work.

In this connection it is well to state that the use of springs in flush-pin gages is not always advisable. There seems to be some difference of opinion about the matter and many designers use no springs whatever. Others use a very light piano wire spring, the size of which depends on the work which it has to do. There is always a certain amount of danger in using the spring for fear that the workmen may not overcome the pressure of the spring in making the contact of the gage on the work.

When work is of large size, as in the example shown at *P*, a heavy and cumbersome gage would be difficult to handle, and yet the amount of surface to be covered is considerable. Aluminum can often be used on account of its lightness, and if properly reinforced and ribbed it will fulfill the requirements. In the example, the gage *Q* is made from aluminum and ribbed as shown. A light section is used throughout in order to keep down the weight as much as possible. Steel strips at *R* and *S* are fastened to the body of the gage and ground in position. Steel washers are also used at *T* and *U* and ground off after assembly with the body of the gage. The flush pins *V* and *W* are of the same variety as those previously shown and the general method used is the same. In this example there are two shoulders to be measured from the upper surface *X*. The designer will do well to consider the use of aluminum in all cases, whether steel or cast-iron bodies are required, and when lightness is an important matter.

Application of Flush-Pin Gages

When a curved surface is to be gaged from a plain surface the flush-pin type of gage may often be found useful. In the example *A* shown in Fig. 539 the work *B* has a curved surface *C* which must be machined in accurate relation to the faces *D* and *E*. A very simple form of gage will give excellent results for work of this character, and the gage shown at *F* is one of this type. The body of the gage is made of steel and ground to a plane surface on the side which fits against the surfaces *D* and *E* on the casting. The flush pin *G* is made in the ordinary manner, except that the lower end is pointed so that it will make proper contact with the curved surface. The upper part of the gage is finished on two surfaces *H* and *K*, which are ground so that they represent the tolerance permitted on the work. A central hole is drilled in the gage at *L*, and a spring can be used here if desired. In order to make sure that the flush pin strikes the curve at the correct point, shoulders can be applied at the ends of the gage to locate it in the right position.

Another application which illustrates the possibilities of flush-pin gages is shown in the example *M*. Here an angle plate *N* is furnished with a stud *O* on which the work *P* is placed. The block *Q* is mounted on the angle plate in such a position that the flush pin *R* can be moved up or down to come in contact with the projecting lugs as the work is revolved. The tolerance is naturally determined by the end of the pin, which is cut away in the usual manner. There are two methods in common use when designing flush-pin gages. The tolerance may be determined either by using a pin like that shown at *R* with the end cut away at *S* and *T* so as to indicate the tolerance, or else the gage itself may be relieved as shown at *U* and the pin ground straight across the top as indicated at *V*. Some designers favor cutting away the pin, while others think it better to relieve the top of the gage as at *U*. Where a pin of small diameter must be used it is better to relieve the top of the gage rather than the pin.

American Engineering Standards Committee Reports One Thousand Simplification Opportunities

MORE than 1,000 outstanding opportunities for the elimination of economic waste through the simplification of varieties and sizes of products are presented in the first analysis of findings in the survey of simplification opportunities which has been carried on during recent months by the American Engineering Standards Committee at the request of Secretary Hoover of the Department of Commerce.

This is in the form of a summary of answers to a questionnaire sent out by the American Society of Mechanical Engineers, one of the member-bodies of the A. E. S. C., to selected lists of its membership which includes all members of its professional division, and shows 123 suggestions of important standardization opportunities in the automotive and aircraft industries; 115 opportunities in building material industries; 54 opportunities among electrical appliances and supplies; 291 opportunities in tools and other machine shop equipment; 64 opportunities in paper, catalogs, books, and printing; 200 opportunities in boilers, valves, pumps, pipe, supplies and kindred products; 37 opportunities in the railroad field; and 191 opportunities in miscellaneous industries.

The A. S. M. E. questionnaire called for suggestions as to three distinct types of simplification opportunities, namely: finished products in which the number of lines could be reduced; finished products in which the varieties of each line could be reduced in number; and raw materials of construction or of manufacture which may be reduced in the number of varieties or kinds.

The answers to this questionnaire represent nation-wide distribution of opinion, both geographically and from the point of view of variety of industry. The A. S. M. E. is the first of the member-bodies of the American Engineering Standards Committee to submit a summary of its findings in this survey. The Standards Committee has asked all of the national technical or engineering organizations included in its membership to make similar surveys in their respective fields.

Among the materials, simplification of which was suggested in the answers to the A. S. M. E. questionnaire, are the following:

Automotive Industry

- Automobiles
- Automobile accessories
- Axles
- Automobile battery sizes
- Lead type storage batteries
- Automobile body hardware
- Automobile body parts
- Automobile bodies
- Automobile carburetors
- Automobile chassis
- Brake lining rivets
- Detachable chains
- Gasoline
- Automobile headlights, reflectors and lenses
- Automobile motors
- Automobile rear axles
- Spark plugs
- Automobile tires
- Automobile tire rims
- Tire fabric
- Motor trucks
- Trailer
- Tractors
- Wheels
- Wheel parts
- Airplanes
- Airplane struts, wires, cables and speed indicators
- Aircraft starting cranks, and ratchets
- Altitude meters
- Landing wheels
- Landing gears
- Propeller hubs
- Turnbuckles
- Bicycles

Building Industry

- Red brick
- Concrete mixers and contractors' plant
- Derricks
- Locks, latches, builders' hardware
- Common lumber
- Widths of flooring
- Thickness of wood
- Mouldings
- Colored wall plasters
- Road or street making material
- Roofing
- Building and roofing papers
- Steel sash windows and doors
- Sash, doors and millwork

Electrical Industry

- Electrical attachment plugs
- Diaphragms on radio head sets
- Electrical fixtures and boxes
- Lighting fixtures
- Electrical wiring fittings
- Panelboards and switches
- Electric fuses
- Electrical motors, motor bases and frames
- Electrical sockets
- Electrical vacuum cleaners
- Transformer oil
- Washing machines
- Insulated electrical wires

Machine Shop

- Ball bearings
- Bronze bushings
- Drive chains
- Conveyor chains and sprockets
- Chucks
- Cotter pins
- Flexible couplings
- Rigid couplings
- Direct connected machinery
- Die notches and tongues
- Flat taper files
- File handles
- Gears and gear reductions
- Gear tooth forms
- Hand tools, hammers
- Joint hangers
- Lathe centers
- Lathe and drill press tapers
- Machine tools and their equipment
- Machine chucks
- Automatic screw machine and turret lathes
- Drill presses
- Grinding machines
- Plain cylindrical grinding machines
- Grinding wheels
- Micrometers
- Oils
- Automobile engine oil
- Petroleum lubricating oils
- Cutting compounds
- Core oils
- Textile oils
- Refined petroleum
- Rivets
- Sell rivets, bolts, nuts, etc., by the thousand, not by weight
- Screws
- Screw threads (pipe and bolt)
- Heads on bolts and screws, nuts ¼ in. machine threads 13 not 12
- Abolish numbered machine screws
- Nuts (hot punched, cold punched)
- Shafting, hangers
- Spindle noses
- Stub ends for push rods
- Tapers
- Taper pins
- Universal joints
- Acetylene welding and cutting blow pipe
- Wrenches
- Wire and sheet metal gages

Paper and Printing

- Accounting Systems
- Uniform system of cost accounting
- Advertisements
- Bookbinding
- Calendars
- Catalogs
- Congressional publications
- Filing cabinets
- Filing equipment
- Filing systems
- Fountain pens, gold pens
- Loose leaf files
- Magazines and catalogs
- Technical publications
- Newspapers and magazines
- Office equipment
- Paper and envelopes
- Paper clips
- Printed forms

Power

- Cast iron heating boilers
- Water tube boilers
- Boiler horsepower rating
- Boiler fittings
- Anthracite coal (standard 2,000 lb. ton)
- Coke, gas
- Coal and ash handling machinery
- Electric current, phase and cycle
- Plumbing supplies
- Fire plugs, service cocks, valves
- Valves (all sorts)
- Indicators
- Pressure, vacuum, hydraulic and ammonia gages
- Ammonia fittings
- Steel for piping
- Reading of gas, electric and water meters

Gas meters
Gas making apparatus
Fuel gases
Packing
Pipe covering
Pipe hangers
Pipe wrenches
Pipe flanges
Pipe unions
Fittings on ice machines
Fire hydrant and hose connections
Soil pipe and fittings
Pumps
Stokers
Stoker engines
Steam condensers
Steam engines and turbines
Steam traps, injectors and steam separators
Tanks
Fans and blowers

RAILROADS

Air brakes for railroads
Box-car roofs
Freight cars
Gondola cars (dumping)
Couplers railroad cars
Locomotive
Passenger cars
Manganese steel track

MISCELLANEOUS

Acetylene torches
Air hose
Bakery machinery
Buttons
Bobbins, paper tubes, twister spools
Chemical glassware
Glasswork bottles
Bottles
Glass jars (re-used)
Clothing
Men's collars
Men's underwear
Men's suits
Women's suits
Women's hats
Women's skirt lengths
Shoes and rubbers
Shirts
Woolen blankets
Furniture
Desks, office furniture
House furnishings
Office fixtures
Hand trucks
Low grade fertilizers
Hand forges
Packing cases
Hooks
Boxes and cans
Shipping containers
Milk cans
Food and other jars and containers
Cans, bottles and containers
Kitchen utensils
Wire goods for the home
Paints and varnishes
Separators-gas, oil
Oiling systems for air compressors, steam and gas engines
Portable air compressors
Gas compressors
Oil field equipment
Pneumatic hammers, drills
Sewing machine needles
Sewing machine woodwork
Soft drinks
Standardization work
Steels
Steel strand
Stoves
Trunks
Garden tools
Talking machine parts
Watches
Weighing scales, automatic
Well casing
Wheelbarrows
Woodworking machinery

Depreciation of a Lathe—Discussion

BY E. F. DUBRUL
General Manager National Machine Tool Builders' Association

THE DISCUSSION of the above subject by C. J. Morrison on page 576, Vol. 58, of the *American Machinist*, and L. L. Thwing on page 694, Vol. 58, would be a lot clearer if these gentlemen had not used the term "value" in so many ways and senses, as to lead one to say, "a plague on all your values." Neither one in using the word, uses it correctly in a technical economic sense.

Mr. Thwing mentions value—sale value, residual value, useful value, salvage value, sound value, and scrap value. Any article has value only at the moment it is exchanged for a price. It may have utility at any time regardless of exchange. It may have great utility and yet have no value, as in the case of air.

Mr. Thwing's illustration of a pair of shoes, worn long enough to be comfortable, but not long enough to be shabby, rather missed the point. The value of those shoes is just what somebody else will give for them. If that value is lower than the utility to the owner, the owner will keep the shoes, but if the utility to the owner is below the value that he can get in exchange, he will sell the shoes.

Mr. Thwing is puzzled by what he thinks is "a difference between sale value and useful or sound value as evidenced by the difference in sale price when the plant is sold as a going business as compared with receipts by dispersal, as the auctioneers now call it." There may be no good will whatever included in the first sale. To its buyer there is the greatest utility of having a plant readily available, completely set up, going and able to supply goods that he will pay for. Such a plant may have completely lost its good will by mismanagement or by mistreatment of customers, so that it would be better for the new owners to not attempt to sell its product as successors of the previous owners. As good will is quite distinct from this definite utility of the going plant, why not clearly recognize the distinction?

DEFINING VALUE

In using the term "useful value" Mr. Thwing seems to mean "utility," and even so, his statement is wrong when he says, "The only time that the sale or salvage value of a machine equals its useful value to its owner is when said owner has no use for it and has crossed it off his books as an active producing unit." How can a thing have "useful value" when the owner has no use for it? This is certainly a contradiction in terms. It is precisely when the utility to him drops below the value which can be realized by sale that the owner parts with a machine or anything else. The old fashioned water wheels have utility and they are continued in use because that utility is higher than the value. The owner of a water wheel compares its utility to himself to the value as measured in a money price that he could get for it. He finds its value zero, but its utility enough above zero to keep it going till it can run no more.

When a plant has lost its utility to any one as a co-ordinated whole, its component parts thereupon have less utility in place and in form and in time, and having lost that utility they bring a lower price which is a measure of a lower value as well as a lower utility.

Many men are puzzled to reconcile the cold fact that a machine in a certain place relation has much greater utility to some people than it has to others at the same time. Machines and other things also have greater utility to the same people at some times than they have at other times. If the machines are so badly worn that they cannot be repaired, or if some other machines have come on the market with much greater productivity than older types, then the old machines lose all utility except such as can be salvaged as raw material. So when the owner seeks to exchange them for money they bring a scrap price which must be less than their utility to the melter, otherwise he would not make the exchange.

If men would keep the distinction between utility and value clearly in mind they would not fall into the errors of thinking that things have any value greater than the price that they can actually be exchanged for under given circumstances of time, place, and form. Most of the so-called valuations that vary so widely when made for different purposes could never be realized by a sale. A sale is the only test of value, and it tests the value only at a given moment. That is another part of the law of supply and demand that ought to be clearly borne in mind but is frequently overlooked.

Ideas from Practical Men

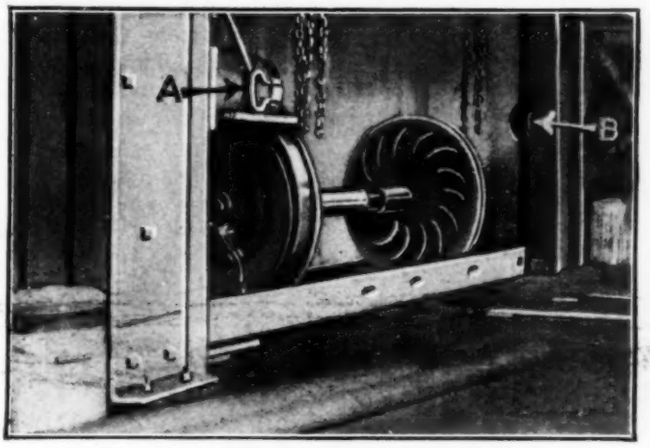
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Home-Made Hydraulic Press

BY HERBERT CRAWFORD

Here is a home-made hydraulic press, designed and made for pressing car wheels on and off the axles of lumber or logging cars. This press was made by the master mechanic of the Mud Bay Logging Co. at its repair shop, Mud Bay, Washington.

As can be seen the frame is built up of heavy structural shapes, channels at the head end and I-beams at the other end. The top and bottom ties are simply flat bars with holes at suitable intervals to hold the back



A HYDRAULIC JACK-PRESS

end, or strap, in the proper position for the different work done.

The business end consists of a hydraulic jack of 150-ton capacity, supported on its side by a shelf, as shown at *A*. Angular tie rods hold the shelf in position. A belt-driven pump hidden behind the head, gives the necessary pressure.

The reason for using I-beams for the back end was so as to be able to cut away a small part of the flanges, as at *B*, to allow the axle to pass through. The opening which was cut with an oxy-acetylene torch, does not affect the strength of the back end as metal has not been removed from the web of the beam, but only from the flanges.

With the aid of a suitable hoist for handling the wheels and axles, a pair of wheels can be removed in 15 min. The press has proved very successful in every way.

Balancing Crankshafts—Discussion

BY T. C. TAYLOR
Essex, England

May I suggest a small refinement to the method described by Frank C. Hudson on page 268, Vol. 58, of the *American Machinist*, on the method used in the Chalmers plant for balancing crankshafts.

In obtaining the static and dynamic balance, it is stated that weights of various sizes are temporarily attached to the crankshaft by means of an adhesive mixture. A cleaner result can be obtained by magnetizing the temporary steel balance weights. The faces of contact would, of course, have to be as nearly as possible of the same contour as the faces to which they are attached.

Half Nuts and High Leads

BY J. T. TOWLSON
London, England

If we turn a shaft with collars extending above its normal diameter, or with recesses cut below its normal diameter, and then bore half boxes to exactly the same diameters, we will find that the half boxes may be placed together on the shaft without difficulty. This is obvious, some one will say.

Go a step further and cut a V-thread on the shaft, providing half nuts therefor, and we will experience no trouble in placing these half nuts together on the threaded shaft. That, too, is obvious—I agree. I have cited these examples only in an axiomatic way in order to make clear what follows.

Cut a square thread on the shaft with just a fair helix angle and provide correspondingly shaped half nuts. Separate these half nuts and try to close them together again on the screw. If the nuts are bored to the same dimensions as the screw and no clearance allowed they will not go together.

An Acme thread, which lends itself more particularly to this class of work, is not quite so reluctant to mate with half nuts and yet, trouble will be encountered quite soon if one tackles a job with high helix angles.

Take, for example, a size often used in factories; a 1 in. diameter Acme thread of 1 in. lead and quadruple thread. Separate the half nuts and try to close them together in the usual way. They will not mate, and scraping must be resorted to. The half nuts will screw on the end of the thread, but, once in place they cannot be separated.

The reason is clear enough when one sees it, though it is seldom fully understood, even by men regularly engaged in this class of work, and these men will "ease" and "ease again" without knowing why. It is because the helix angle at the core diameter of the nut is greater than the helix angle at the surface of the screw, and the difference between these two angles, while allowing the nut to be screwed on from the end, prevents the halved nuts from being placed together on the screw.

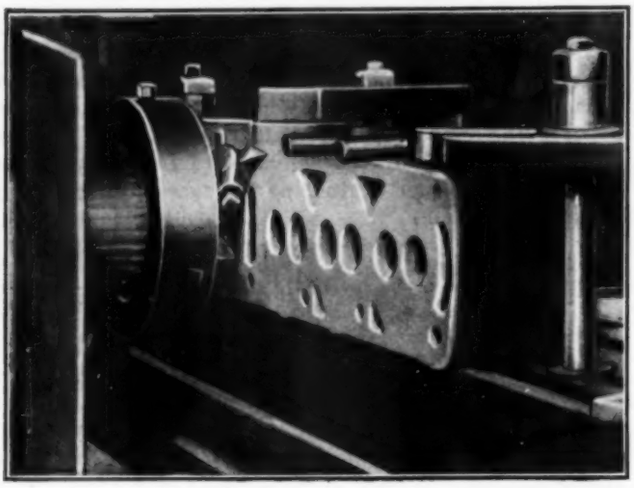
High leads and small diameters are the cause of the trouble, and in making half nuts for such purpose it is a far better plan to reduce the arc of contact to one-third instead of one-half than to spend so much time in fussing and fitting to get them together by indiscriminate scraping.

An Improvised Milling Cutter

By Henry M. Clary

In a shop where the supply of milling cutters of various sizes is limited, the tool shown in the illustration can be rigged up with little difficulty and can be adapted to a wide range of uses.

The Eagle Machine Co., Indinapolis, Ind. had some automobile cylinders to face off on the top but found



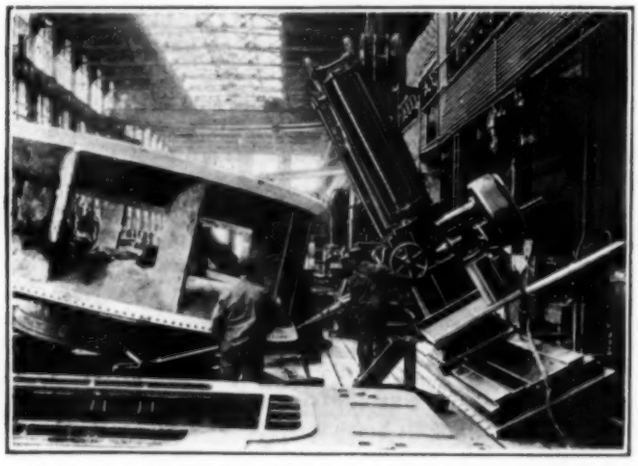
USING A LATHE TOOL AS A MILLING CUTTER

that the largest milling cutter was too small in diameter to use without taking two cuts, and this, as is well known, would not produce a perfect surface. A chuck-adapter was threaded to fit the spindle of the milling machine. Then a chuck was attached to the adapter in the usual manner and an Armstrong tool holder holding a tool-bit was gripped in the chuck as shown. This gave a solid, substantial tool that could be adjusted with little difficulty and a first-class job was produced in short order.

Drilling at an Angle of 45 Degrees

By Howard Campbell

The illustration herewith shows how the Allis-Chalmers Co., Milwaukee, Wis., drilled the bolt holes in the rims of the speed rings for a set of three hydraulic turbines for the Alabama Power Co. There were 720 1⅛-in. holes to be drilled through the two rims of each speed ring at an angle of 45 deg. The rings were of cast steel, 12 ft. in diameter, each weighing over 14,600 lb., and the thickness of the rim on the bolt circle was two inches.



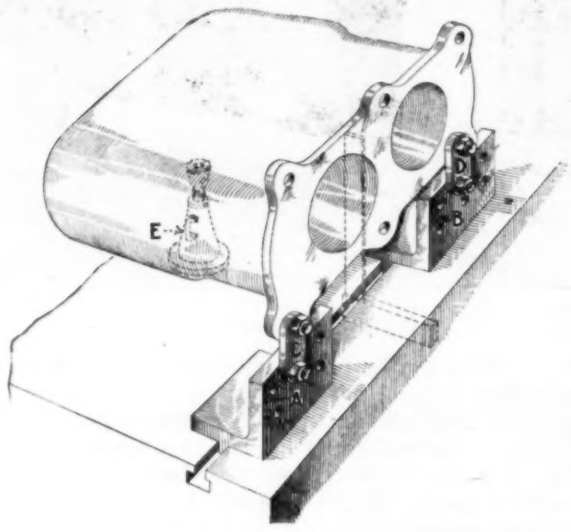
DRILLING ON A 45 DEG. ANGLE

A turntable was placed so that its center was in line with the spindle of a Pawling & Harnischfeger No. 12 horizontal boring and drilling machine, then the turntable was blocked up under the opposite side from the boring machine until it stood at an angle of 15 deg. The boring machine was then tilted toward the turntable at an angle of 30 deg., as shown in the photograph. After the bolt-hole circles were laid out, a speed ring was lifted onto the turntable by means of the electric crane, clamped in position, and the holes were drilled in sequence, a helper revolving the turntable with the aid of a wrench. The entire job was done in one day.

A Method of Holding Cylinder Blocks for Grinding

By Robert Brainard

An automotive repair shop in Salt Lake City, Utah, has abandoned the usual method of holding cylinder blocks on grinding machines. It was found that in a number of designs of cylinder blocks, the ordinary hold-



METHOD OF HOLDING CYLINDER BLOCKS FOR GRINDING

ing fixture with the usual cast-iron framework and with bars across the top and bottom was not convenient to handle or easy to adjust, so it has been abandoned.

The fixtures now used are shown herewith and consist of small angle blocks such as *A* and *B*, each with a number of holes tapped to receive ½-in. capscrews. The blocks have tongues which fit in the usual T-slot in the grinding-machine table. Links of various length are provided as at *C* and *D;* which support the front end of the cylinder block at any desired height, while the back or upper end of the block is supported by a small screw jack as at *E*.

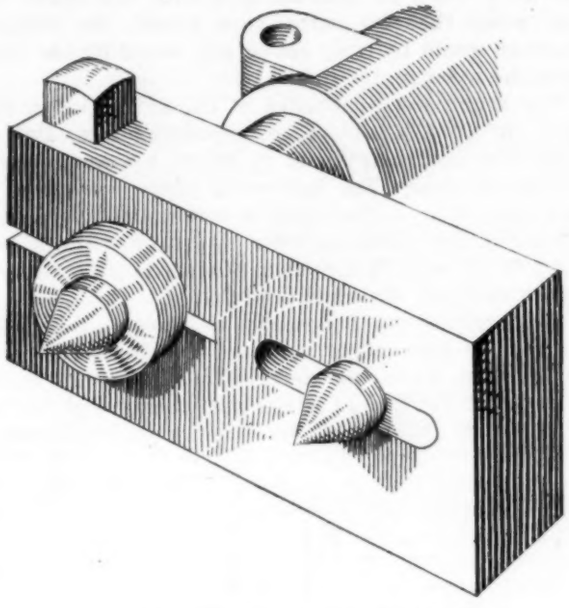
Care is taken to locate the angle blocks at right angles to the grinding spindle and the face of the cylinder block is squared with the table by a steel square as shown in dotted lines. Should this face be out of square, it is equalized as nearly as possible.

Turning Tapers on Old Lathes

By Donald A. Hampson

There are any number of lathes without taper attachments or compound rests, some of which are modern though most of them are old and are spending their declining years on jobbing work. Taper-turning on such lathes must be done either by setting over the tailstock or by feeding free-hand, the latter an accomplishment that requires some little practice. Shifting the tailstock is a recognized method and, for work held between centers, answers every requirement within the limits of the set-over.

Short pieces of work can be handled on centers with the rear center shifted to suit but, as the amount of



AUXILIARY CENTER FOR TAPER TURNING

set-over rarely exceeds 1½ in., it may readily be seen that while the extreme set-over will produce a very stubby taper on a piece 6 in. long, on a piece that is 6 ft. long the taper would hardly be noticeable. It is in connection with these longer pieces that the limitations of this method of taper turning are felt. Take, for instance, an automobile axle; the shortest length encountered in those having tapered ends is about 30 in., and a tailstock that can be moved but an inch will not come anywhere near the requirements.

When it comes to full length axles with tapered ends, the lack becomes doubly apparent. Examples of this class of work are the axles used in horse drawn trucks and army vehicles, trailers, push cars and light railroad equipment. These full length axles seldom have as much taper as the divided automobile axles (rarely over 2 degrees on a side) but their length of about 64 in. brings the set-over required well outside the limit provided.

The drawing herewith shows a simple attachment made and used in a shop that had occasional railway car axles to turn, as well as axles for automobiles. The railway axles tapered from 1 13/16 to 1 7/8 in. in a length of 3½ in., and the attachment had been devised primarily as an inexpensive way of doing work that had formerly been done by spotting end diameters, free hand turning between, trying with a steel rule, and filing and fitting to the hole.

A block of steel 2x3 in. had been bored to fit over the tailstock quill, split, and fitted with a clamping bolt. Then a slot was cut through the block at some distance from the first hole. A center was turned up of the same size as those already in the lathe, shouldered, flattened to slide in the slot, and a nut and washer put on the back end. The slot in the block was so placed that the auxiliary center when in the near position overlapped the position of the regular center when the latter was set-over to the limit. From that, a range of 2 in. more was provided.

The screw at the split end takes care of keeping the auxiliary center in a fixed vertical position but, as an additional safeguard and when a heavy cut would be advisable, the steadyrest is applied as near as convenient to the section being turned. This precaution effectually counteracts the upward thrust of the tool. On rough stock, a place is spotted for the steadyrest jaws.

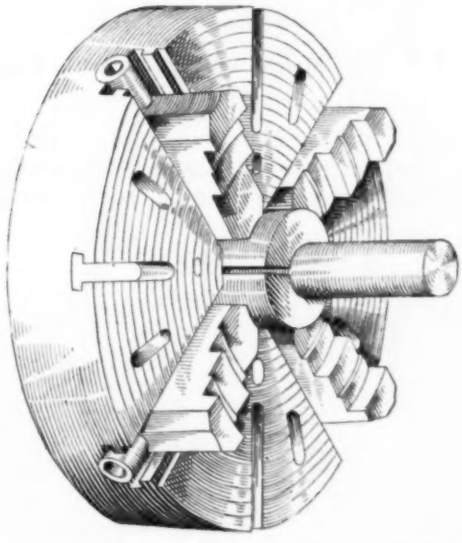
While such an attachment is to be classed with makeshifts, it is entitled to a high rating when measured by such standards as first cost, adaptability, speed, and production.

To Hold Small Bars in a Chuck —Discussion

By J. T. Towlson
London, England

In an article under the above title, published on page 197, Vol. 58 of the *American Machinist*, F. M. A'Hearn has indeed given us a bright idea, though he fails to tell us to what range of sizes his method of holding small round bars is adapted.

Our way of holding such pieces, say from 1/16 to ½ in. in diameter, is to make a number of sub-chucks, one for each size of round. These sub-chucks are merely short pieces of round bright stock, drilled and reamed to the



SUB-CHUCKS TO HOLD SMALL ROUNDS

size each is to hold and slit down the length of one side to give them the necessary spring to allow them to close on the work. The outside diameter of the subchuck may be made of any size desired, providing it is sufficiently large to be gripped in an ordinary lathe chuck.

Threading Staybolts in a Lathe

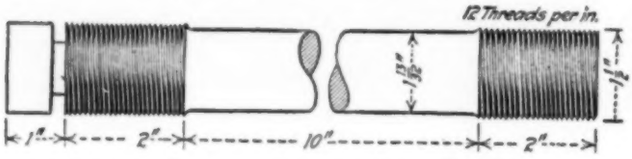
By J. Sylvester

Being employed in the repair department of a large plant where the range of jobs that fall to my lot is far beyond the capacity of a rather meager equipment and all are wanted in a hurry, I am often obliged to resort to expedients that would not have to be considered in an average machine shop.

One such job was the making of a lot of about 500 staybolts, 1½ in. in diameter, 12 pitch, as shown in the sketch. Though there was a bolt threader in the shop there was no 1½-in. die and no time to get or make one, so I finished up the work on a 16-in. engine lathe; making a very good job and fair time, as follows:

I made three operations of the job: Centering one end, necking the opposite end, and threading. All went well until I started to cut the threads with a single-point tool; then there was trouble, for the stock was rough and badly scaled.

After several discouraging attempts to get a good thread, I finally took a discarded 12-pitch chaser from the ½-in. die of the bolt machine, ground it so as to get



CUTTING STAYBOLTS IN THE LATHE

a little more clearance at the bottom of the first three or four threads, and ground the upper surface to give good sharp cutting edges to all the threads.

This multiple tool I put in the toolpost of the lathe and used it as a chaser in place of the single-point tool. By using plenty of lard oil I was able to get good threads at one pass, and with the help of the graduated dial on the crossfeed screw I had no difficulty in maintaining the size.

A Kink in Pressing in Bearings

By Joseph M. Pescorse

It has been the writer's experience that in pressing bronze bearings into aluminum castings, a certain amount of shearing takes place in the aluminum. I

BUFFING THE ENTERING EDGES OF BEARINGS

have tried chamfering the entering ends of the bearings at a very slight angle, but this did not prevent the shearing action.

Bearings can be chamfered or the corners rounded in the lathe, but the circular scratches left by the tool will cause shearing when the bearing is pressed in.

I have eliminated the shearing action by buffing the corners of the bearings so that the cutting lines lie in the same direction as the motion in pressing them in. The sketch shows the idea.

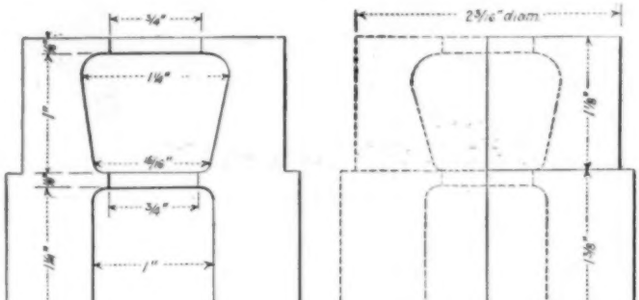
A Problem in Accurate Machining

By I. M. Beck
Glasgow, Scotland

A number of pieces were required to be made as shown in Fig. 1, of a special alloy. The completed article consisted of two identical parts, as the view to the right indicates, and it was essential that the individual pieces be made to such degree of accuracy that any one piece could be interchanged with any other piece and, when the two parts were joined, the contained chamber would be truly round and would divide exactly upon the axial center line.

The rough stock consisted of blanks 2⅛ in. in diameter, cut from a bar of corresponding size, and each blank was split lengthwise in halves by sawing it in a milling machine. The half-round pieces were then held face upward in a vise upon a vertical milling machine while the flat surfaces were swept off with a single point fly cutter. This method produced excellent results, as the surfaces were left dead flat.

A mandrel was then made, as shown in Fig. 2, to be held in the spring collet of a Warner & Swasey turret lathe. Care was exercised in making this mandrel to have the flat face at *A* coincide exactly with the axial center line. Each piece was then placed with the flat



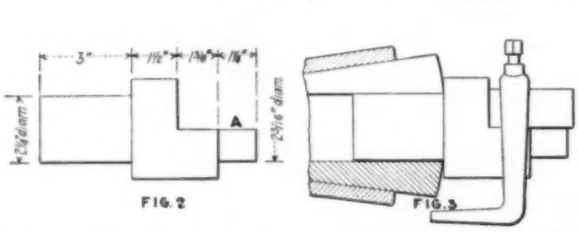


FIG. 1—THE PART TO BE MADE. FIGS. 2 AND 3—THE MANDREL AND METHOD OF HOLDING THE WORK

face in contact with the corresponding face of the mandrel and held by means of a lathe dog as shown in Fig. 3 while the 2⅜ in. diameter was turned to a limit of ± 0.001 inch.

Two if the pieces would then be placed together and held in a collet by the 2⅛ in. diameter while the remaining diameter was turned and the chamber machined in the ordinary way with drills and reamers. The tapered portion of the chamber was made with a single point tool held in the compound rest, which was set to the corresponding angle.

One Way of Making a Screw Conveyor

By Frank C. Hudson

There is more than one way to make a helical or screw conveyor. Here's how a small shop in Los Angeles, the Mills Iron Works, does it in small quantities of course.

The round disk *A*, Fig. 1, about 12 in. in diameter and perhaps 3 in. thick is riveted in the center of a good sized square plate as shown. A pin *B* is driven in the plate about 2½ in. from the disk and the fixture is ready for use.

The stock for the helix of the conveyor flights is of flat steel about ⅜ x 2 in. It is heated in an oil fire for perhaps 18 in. from the end and the end is placed between the pin and the large disk *A*, after which the

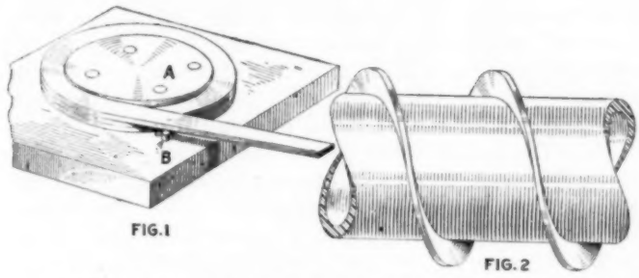


FIG. 1—COILING THE FLAT BAR. FIG. 2—COIL OPENED AND MOUNTED ON A LARGE PIPE

bar is bent around the disk edgewise. It takes more or less coaxing with a sledge, to induce the bar to lie flat on the plate as it has an inclination to bend flatwise instead of edgewise.

Several heats are taken and the process repeated until about three turns are made. Less coaxing seems to be required as the coil builds up, probably because it is easier to reach the strip with the sledge, or perhaps it gets used to being bent this way.

The coil is then opened out and mounted on the outside of a large pipe as shown in Fig. 2. By having the disk *A* a little smaller than the pipe on which the helix is fastened it is necessary to untwist it a little to get it over the pipe, and in this way it closes on the pipe very tightly, like a spring and only needs to be fastened at the ends.

Regrinding, Reboring or Reaming Cylinders—Discussion

By Henry C. Francis

On page 744, Vol. 58, of the *American Machinist*, in an article under the above title, M. I. Seiler contends that reaming is the only good method of refinishing motor cylinder-bores. I have no quarrel with the reaming method when it is properly done by a skilled man, and with a reamer and fixture which will insure both a round hole and one which is perfectly square with the face of the cylinder block. The main objections to reaming are the tendency of the reamer to follow the hole in the block whether it is square or not, and the fact that it is frequently necessary to remove more material than where the cylinders are refinished by grinding.

It seems to me that Mr. Seiler is rather unfortunate in stating his objection to the grinding process. Experience has entirely exploded the notion that ground cylinders wear faster, owing to the small particles of abrasive which remain in the cylinder bore. Mr. Seiler refers to the failure of the compound to wash out the small particles, when as a matter of fact nearly all cylinders are ground dry, and there is much less danger of abrasives remaining in the walls than where the cylinders are lapped. Yet many well known builders lap the cylinders of their motors.

Clamps For Die Workers

By I. B. Rich

Here is an old timer's method of holding templets on die blanks for scribing or laying out. The clamp shown in Fig. 1 needs no description, except perhaps to say that the legs are made long so as to allow ample space both between them and above the templet, so nothing will interfere with scribing.

The screw that works through the block connecting and holding the legs is provided with extension points which screw into the lower end to allow for wide or narrow die blocks and still make it easy to hold the templets while scribing the outline.

This device was found in the shop of the Arizona Machine Co. in Phoenix—in tool kit of the proprietor, Mr. Henderson, who brought it from the Naugatuck Valley where he formerly held forth in the Waterbury-Farrel Foundry and elsewhere. It is hard to go anywhere in this old U. S. A. without bumping into someone who has graduated from some of the old shops of New England.

Another kink from the same kit, shown in Fig. 2, is a universal clamp for use in filing dies. The lower jaw has a small cylindrical extension which goes through the ball *A*. The ball has a similar extension or stem which

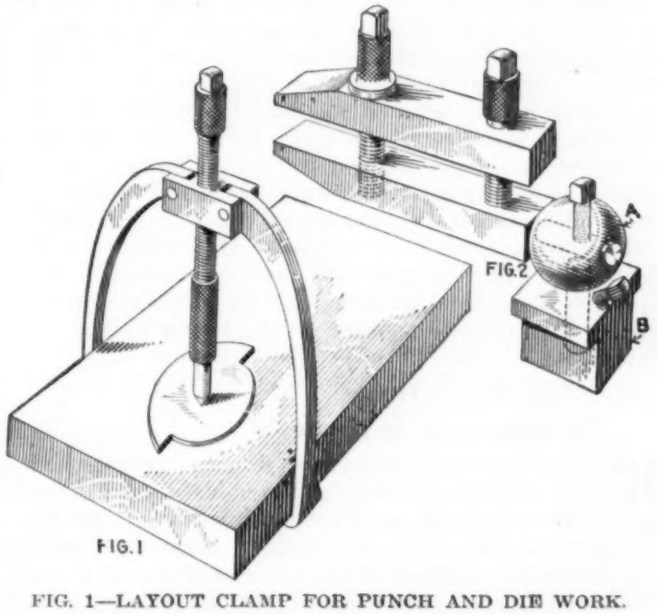


FIG. 1—LAYOUT CLAMP FOR PUNCH AND DIE WORK. FIG. 2—UNIVERSAL CLAMP FOR DIE FILING

fits into the block *B*, the latter having parallel sides to fit into a vise. Lips at the top rest on top of the vise jaws. With the block clamped in the vise and a piece of work held in the clamp, the work can be swung into any desired position and clamped firmly by the two setscrews shown at the right.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors
May 31, 1923

Rapid Growth Of Transportation Needs

SOME IDEA of the need for railroad development may be had from the figures brought out by the Committee of the Chamber of Commerce of the U. S. on Waterways and the Co-ordination of Rail and Waterway Service. Going back over a fifty-year period the figures show that while the population has increased 2.7 times, the railway tonnage alone is now 17 times as great as in 1873. In other words, the country as a whole is more dependent on other localities and sections than it was fifty years ago. The tonnage has grown six times as fast as the population and is still growing at about the same rate.

Even under the best of conditions and management the railroads are confronted with a great problem to keep abreast of transportation demands. They should, if possible, be a little ahead. The lagging behind demand as witnessed during the past few years has meant a distinct economic loss and has imposed hardships when coal could not be brought to market as fast as it could be mined. According to Mr. Hoover the economic loss due to the lack of transportation facilities was greater than the cost of running the government.

Attacking railroad management as being all wrong or defending it as all good, will not solve the problem. In common with other industries it must recognize that efficiency depends on both men and machinery. Old equipment and antiquated methods must give way to newer and better ways of doing work. Co-operation must replace antagonism and strife. Economical maintenance of rolling stock is a necessary part of reducing costs of transportation. Modern machine equipment and methods, as well as a greater standardization of locomotive and car parts are necessary steps in the progress which must be made. Let us all work together for the lasting betterment of all our railways.

Individual Motor Drive Is Increasing in Favor

RECENT investigations among both builders and users of machine tools in the middle west indicate that individual motor drive for machine tools is rapidly increasing in favor. In the old days, power was transmitted to the machine through the medium of a belt which ran from the flywheel of the steam engine to the main line shaft. This was replaced by a generator which supplied current to motors which drove the line shafts, then smaller motors and more of them were installed, each driving a number, or group, of machines. At this point the question arose as to how far power could be subdivided with economy. Tests were made by production engineers, the results of which showed that a considerably smaller amount of electricity was consumed in the operation of a 30-hp. or 40-hp. motor, driving a number of machines, than would be required if a motor, even though proportionately smaller, were applied to each machine.

Comparisons of costs in the last few years have, however, disclosed that there are many factors to be taken into consideration besides that of current. The cost of belting, time required to hang countershafts, time and oil required to keep the countershafts oiled and the cost of repairs when it is not done—all these add up to a sizeable figure. In the small shop it often happens that three-fourths of the equipment is idle, while the cost of power remains the same. As the shop grows and new equipment is added, machines have to be shifted to make room for the newcomers, with all the attendant labor and cost of taking down and re-hanging countershafts. The larger shops, of the variety known as "production" shops, frequently change the design of their products or enlarge their capacities, with the result that whole departments have to be moved about. Here again the extra cost of current is offset by the cost of moving power transmission equipment, to say nothing of loss in production while the change is being made.

Why Small Shops "Roll Their Own"

WE ARE VERY apt to wonder why so many small shops make machines for themselves instead of buying standard products which are on the market. Of course, ready money is always a factor and is frequently a serious matter with the small shop. But terms can usually be arranged when the proprietors are known to machinery dealers.

There is, however, another reason than ready cash which many small shop proprietors must and do consider. With few exceptions they fully realize the advantages of standard machines and have no delusion as to the home-made machine being cheap when all costs are considered. But few small shops can so plan their work as to be uniformly busy. Jobbing work is almost invariably a fluctuating business, very busy at one period and slack in others. In some cases it seems to vary each week or month. Some contend that the last days of the week or month are apt to be slack while the early days of the month are more busy. In any case there are slack days when it becomes a problem to keep men busy. And all know that they cannot expect real co-operation in busy times if men are laid off as soon as business drops off.

On this account the small shop manager frequently plans his work so as to keep his men busy on special work for his own shop when outside work slacks off. He keeps it for "knitting" to fill in hours when the men would be otherwise engaged in discussing the baseball scores or other interesting but unprofitable topics. The problem of steady employment is one of the greatest which faces the business world today and affects all businesses in one way or another.

Shop Equipment News

Davis & Thompson Vertical Boring and Turning Machine

A machine designed especially for boring and turning piston-ring pots and similar work has been developed by the Davis & Thompson Co., Milwaukee, Wis. The machine, which can be seen in Fig. 1, is of the vertical type and consists principally of a central column around which the work table and tool spindles, together with the necessary operating

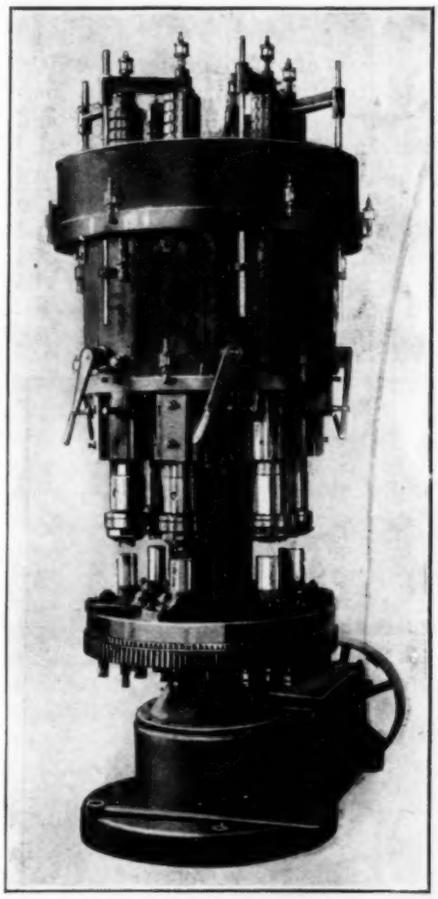


FIG. 1—DAVIS & THOMPSON BORING AND TURNING MACHINE

mechanisms, revolve. The upper part of the machine, or turret, does not index, but revolves continuously with the work table. The machine is built to carry six castings, each casting being finished as the table revolves around the column, thus producing six finished pieces with each complete revolution of the table.

At each of the six work stations on the machine table is a steel plate through which project three bolts, each with an eccentric head. The bodies of the bolts project below the table and each bolt carries a friction gear, all three gears meshing with a gear on a central screw. The operation of clamping a piece in place consists of turning the central screw, the gears turning the heads of the bolts around until they engage the work; then the central screw is tightened in the same movement, which tigntens all three bolts. Thus the process of chucking consists of but one operation. Reversing this process loosens the bolts and swings the bolt heads away so that the piece can easily be removed.

On the upper end of the main spindle of the machine, which is housed in the main column, is a gear which meshes with the six gears on the upper ends of the spindles that carry the tools. Each spindle is 5 in. in diameter and has a left-hand square thread cut at the top, as shown in Fig. 2. Beneath the gear on each spindle is a nut which, by a system of differential gearing, is made to turn faster than the spindle, thus giving the desired feed.

To the top of each spindle is attached an arm that carries a trip rod, which can be adjusted to trip the feed at any desired point. When the spindle has reached the lowest point of movement, the trip rod trips the catch placed on the outside of the turret. The catch releases a spring, which is located in the spindle housing, the action of the spring releasing a clutch from the feed gear and engaging a friction plate to overcome the friction of the nut on the spindle and hold the nut from turning. As the spindle is revolving while the nut is stationary, the spindle is fed upward through the nut to the starting position. Here the nut is again free to turn, ready for the operator to engage the feed by engaging the clutch with the nut.

The lower end of each spindle is bored and reamed for a No. 5 Morse taper shank, and the outside of the spindle is tapered and threaded as shown in Fig. 3. The turning tool holder consists of a steel sleeve *A*, which is threaded inside to fit the spindle, and is tapered on the inside of the upper end to fit the corre-

FIG. 2—TOP OF MACHINE SHOWING SPINDLE-OPERATING MECHANISM

sponding taper on the spindle. The sleeve carries three tool bits of $\frac{3}{8}$-in. square high-speed steel, which are supported by a collar that can be screwed up or down to obtain the necessary adjustment. A lock collar prevents the adjusting collar from working loose. Larger or smaller sleeves can be made to fit the spindle, according to the size of the work.

The boring tool holder is made in three parts, a body *B*, a sleeve *C*, and a plug *D*, which serve as a support for the tools. The body is made with a No. 5 Morse taper shank to fit the spindle, and is threaded as shown. The steel sleeve which carries the three tool bits is threaded to fit the thread on the body of the holder, and the plug *D* is threaded to screw into the sleeve. The bottom of the plug is tapered on a 45 degree angle so that it will provide suitable support for the tool bits, and it has a slot cut in it for a wrench to provide for easy adjustment. Setscrews are also provided through the bottom of the sleeve, so that the tools can be locked in position after being set.

The work locating plates and clamping mechanism can be adapted to the size of the work, and change gears can be applied to the spindles to obtain the desired speeds and feeds. The maximum spindle travel is 18 in. on the machine shown in the illustration, but can be made to suit any job. The largest diameter of work that can be accommodated is approximately 8 inches.

The spindle operating mechanism is enclosed, as shown, to keep out the

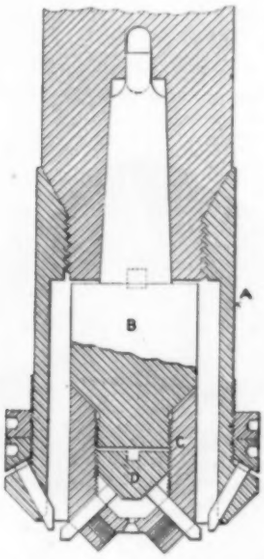


FIG. 3—DETAILS OF TOOL HOLDER

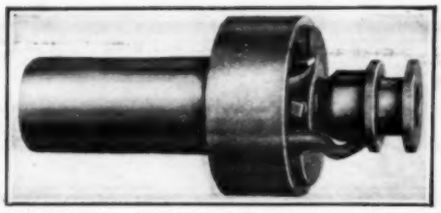
dust. Lubrication is provided for all operating parts through the medium of sight-feed oilers.

The machine as shown is motor driven, being equipped with a constant-speed 25 hp. motor. The machine will, however, be supplied for belt drive if required. The floor space required is 4x6 ft. The net weight of the machine is 9,500 lb., and the weight crated is 10,680 pounds.

Conway Expansion Friction Clutch

A clutch for geared-head lathes and other single-pulley-drive machines making speed changes by means of gears has recently been placed on the market by the Conway Clutch Co., Cincinnati, Ohio.

The feature of this clutch is its release. The friction band because of its inherent resiliency springs free from the drum and is held tightly concentric to the shaft by means of a guide that is machined on the periphery of the carrier. This action provides a space of 0.01 in. between the friction band and the



CONWAY EXPANSION FRICTION CLUTCH

drum at all points when the chuck is released.

A large lever ratio is embodied in the clutch, which reduces the power required for shifting and permits the use of shorter levers. The clutch is adjusted by means of one screw. All the actuating parts are made of hardened Hyten alloy steel. They are also interchangeable between clutches and made to standard gages.

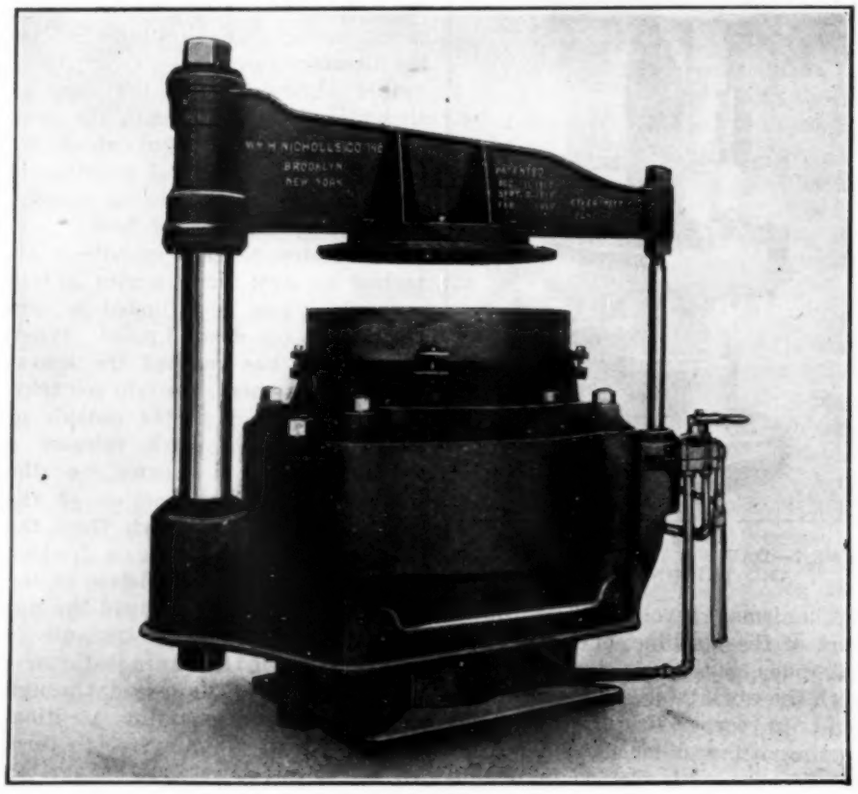
Nicholls Car-Wheel Molding Machine

For the purpose of producing by machine sand molds for the standard 33-in. railroad car wheels, the William H. Nicholls Co., 2 College Place, Brooklyn, N. Y., has recently brought out a combination jolt, squeezer and stripping molding machine. The machine is intended for use instead of a plain jolt machine, which may produce overweight castings because of the varying density of the sand throughout the mold, and it does not require the placing of a heavy weight on the sand as is sometimes done during jolting.

This machine, which is illustrated herewith, first jolts the mold about six times to prevent packaways and ram-offs, after which the pattern table is elevated, thereby bringing the mold in contact with the top platen of the machine. On this platen is a tucking plate which is made to conform to the contour of the pattern, so that when the pressure is exerted the sand is evenly distributed throughout the flask and a mold is produced which is uniform in density. The pattern is then drawn on the exhaust stroke of the squeezing piston without consuming any added time or power.

The mechanical operations require about 13 sec. and after the flask has been filled with sand, the mold can be completed and ready for lifting off the machine within 18 or 20 seconds.

A press of approximately 30,000 lb. capacity is incorporated in the machine, together with a jarring and pattern-drawing device. The total weight is in excess of 11,000 lb. All cylinders and pistons are ground to size, while hardened and ground guide pins and bushings are used throughout. It is claimed that the maintenance per year does not exceed 10 per cent of the initial cost.



NICHOLLS CAR-WHEEL MOLDING MACHINE

"American" Twelve-Speed Automatically Oiled Geared-Head Lathe

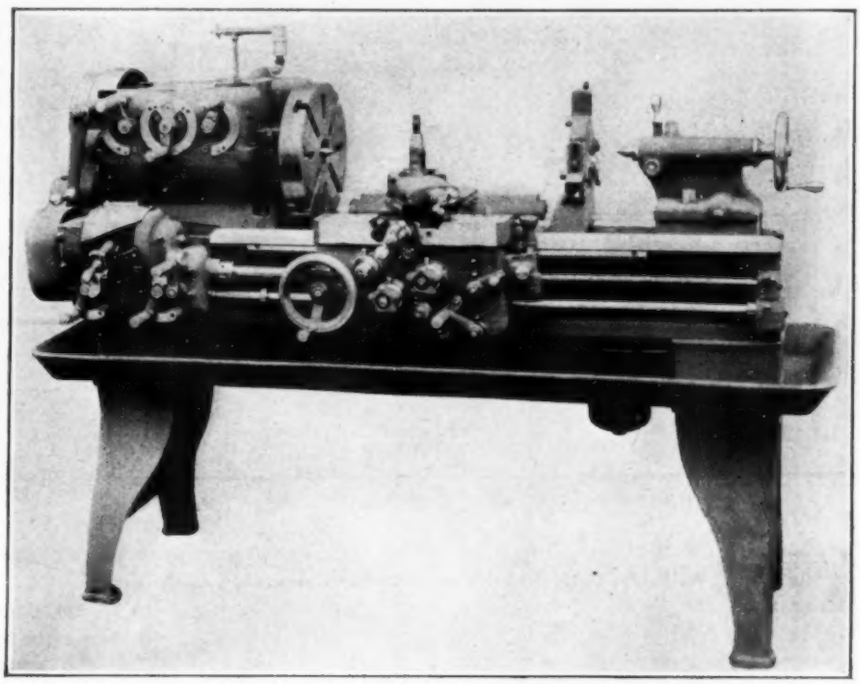
A recent development of the American Tool Works Co., Cincinnati, Ohio, is the twelve-speed automatically oiled geared-head lathe shown in the accompanying illustration. These geared-heads are made for all sizes of "American" lathes up to and including the 36-in. medium pattern lathe, and they provide twelve mechanical spindle speeds in geometric progression.

All the gears in the head are made from heat-treated manganese steel, and all speed change gears are hardened. Only three shafts are used in the head; therefore the gear centers can be located further apart, and consequently larger diameter gears are used than in the average four-shaft heads. The entire mechanism operates in a bath of oil, which in conjunction with the liberal proportions of the gears and shafts, is claimed to insure long and satisfactory service with a minimum of wear.

The head is under constant control through either of two levers, one located at the right side of the apron, and the other at the left side of the head. These levers operate the friction clutch incorporated in the driving pulley or in the driven gear of the motor train, if motor driven. A band brake operates in unison with the friction clutch, and is engaged when the clutch is released. The spindle may be instantly stopped or allowed to drift when the driving clutch is released; and in addition, it may be securely locked in its stationary position by means of the brake, thus guarding against the accidental starting of the spindle through possible drag of the friction clutch.

The construction of the driving pulley is one of the chief features. In order to remove the belt pull from the driving shaft, the pulley is bronze bushed and mounted on a long steel sleeve of large diameter, which takes the belt pull. This sleeve is also bronze bushed and forms the journal for the driving shaft to which the pulley is keyed. An automatic circulating oiling system provides lubrication, and reduces the possibility of the pulley drive unit running dry.

Another improvement is the gear-tooth clutch used on the high-speed drive in place of the jaw clutch. The advantage of the gear-tooth clutch is in its ease of engagement. It consists of an external and internal gear of the same diameter, pitch and number of teeth. It is engaged and disengaged in the same manner as an ordinary transmission gear is slipped in and out of engagement. The teeth of this clutch are generated on a Fellows gear shaper, and are rounded on the ends by a machine to prevent any hesitancy in engagement. Both the internal and external members of the clutch are made of heat-treated and hardened alloy steel.



"AMERICAN" AUTOMATICALLY OILED GEARED-HEAD LATHE

An automatic oiling system is employed to lubricate the geared heads. By means of a geared pump accessibly located inside the head the oil is pumped from a reservoir in the bottom of the head to a filtering and distributing tank in the cover of the head, from which every bearing in the head is lubricated. After filtration takes place the oil gravitates to the various bearings through oil pipes leading from the filtering tank. The oil pump supplies oil to the filtering tank faster than the filter can take care of it, and in larger quantities than the bearings will consume; consequently the surplus overflows and cascades over the gear teeth, keeping them lubricated with cleansed and strained oil.

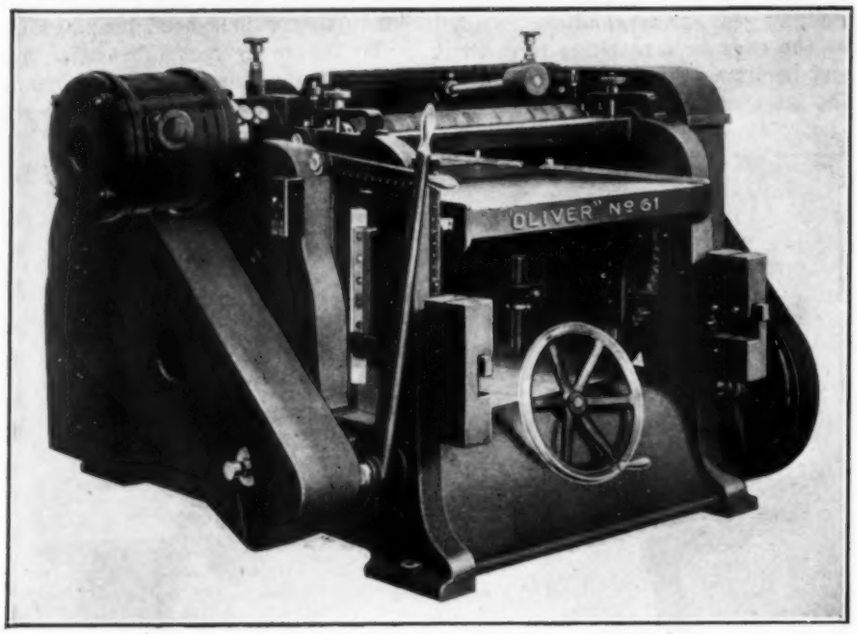
The oil first flows into a settling tank in the lower head casting, where all heavy particles of foreign matter settle to the bottom. As the oil accumulates in this settling tank it overflows into a straining compartment, where it passes through a fine-mesh metal gauze strainer into the pumping reservoir. From this point it is lifted by the pump into the filtering tank in the head cover, where it is filtered through a felt pad ½ in. thick before it reaches the distributing chamber, from which it is led to the various head bearings.

To insure perfect lubrication for each bearing, the distributing chamber is divided into compartments, each one of which holds a supply of oil for one particular bearing. From these compartments oil pipes carry the oil to the various bearings. As a consequence of this system each bearing is assured of a supply of oil, which cannot be diverted to any other bearing. A removable plug in the bottom of the settling tank provides means for removing the sediment from the tank, while a signal glass in the supply line from the straining compartment to the filtering tank shows the operator how the oil pump is working.

It is stated that with the "American" automatically oiled geared head, the 24-in. heavy pattern lathe will easily accomodate a 20-hp. motor up to its full capacity, while on the belt-driven head the power is delivered to a 16-in. driving pulley by a 6-in. double belt. This powerful drive is employed so that the full capabilities of the machine can be utilized.

Oliver Direct Motor Driven Wood Surfacers

The Oliver Machinery Co., Grand Rapids, Mich., has made a number of improvements on the No. 61 surfacer described on page 889, Vol. 48, of the *American Machinist*. The feature of the improved machine, which belt drive is used. It carries thin air-hardened high-speed steel knives that are clamped against hardened steel chip breakers. These chip breakers consist of 1½-in. sections mounted on two horizontal bars.



OLIVER DIRECT MOTOR DRIVEN WOOD SURFACER

is shown in the illustration herewith, is the drive, with the motor mounted directly on the head.

The motor-on-head drive is recommended whenever a 3,600 r.p.m. polyphase a.c. motor may be used. This type of drive employs no motor shaft, as the rotor is mounted directly on the shaft of the cutter head or cylinder. The machine may also be furnished with a "coupled-to-cylinder" drive when d.c. 3,600 r.p.m. motors are used, or a "coupled-to-countershaft" drive when motors of 1,800 r.p.m. or less, either a.c. or d.c., are used.

The bed is supported on square-thread screws with ball bearings, which reduce the friction and permit the bed to be easily raised. The bevel gears used in elevating the bed are protected from dirt by a wide shelf that covers the inner space below the table and keeps the shavings from within the frame. At each side of the bed is a guide to prevent the material from leading away from the bed and striking the frame or gearing.

The cylinder is made of crucible steel and is belted at both ends when They yield concentric to the cylinder independently of each other.

The feeding power is transmitted by means of belts from the cutting cylinder, four speeds for the work of 14, 18, 24 and 34 ft. per min. being available. There are four feed rolls, one pair being back of the cylinder to feed the material free of the knives and to assist in carrying it through the machine. They are 4 in. in diameter, made of hammered steel and supported in self-oiling boxes. All the rolls are driven by a train of heavy gears. The feed-in rolls are weighted, while the delivery rolls have spring tension. The upper feed-in roll is corrugated for gripping the stock firmly. A cover is provided for the upper delivery roll and it also has a scraper to keep the rolls free from shavings.

Sectional feed rolls may be furnished. They consist of sections 1⅛ in. wide and 4 in. in diameter which give a positive drive horizontally but yield vertically independently of each other to the extent of ⅞ in. Each of these sections is composed of an outer ring enclosing four sections or seats placed radially to the center of the roll shaft and each carrying a helical spring.

The machine is made in two sizes, to plane material 24 or 30 in. wide. The bed in both types will lower to receive and plane material up to 8 in. in thickness. The machines are regularly equipped with ball bearings, but babbitt bearings may be furnished. The latter are of the self-oiling side-clamping type with large oil chambers. Each surfacer is regularly equipped with a knife setting and jointing or truing attachment, consisting of a bar, locating brackets and slide blocks. A motor-driven knife grinding attachment may also be furnished.

The smaller machine, known as the No. 99 surface, which was shown and described on page 289, Vol. 53, of the *American Machinist*, has also been improved in the same manner as the larger machine, and is now designated as the No. 199 surfacer. It is also made in two sizes, to plane material 20 and 24 in. in width and 6 in. in thickness.

"Cle-Forge" Twist Drill

The hot-forged drill, while it has toughness, has a web which in many cases is not central because of the twisting process it has undergone when the flute was being formed. On the other hand, the milled drill, while not being as tough as the former, is used in far greater quantities because it has a centrally located web and is uniform in character, thereby producing more uniform holes.

The accompanying illustration shows a tapered twist drill known as the "Cle-Forge" that has recently been placed on the market by the Cleveland Twist Drill Co., Cleveland, Ohio, and which is claimed to possess the advantages of both the hot-

"CLE-FORGE" TWIST DRILL

forged and milled drills. This claim is based on the fact that the drill is first hot forged to impart toughness and then it is machined in the same manner as the milled drills to give the accuracy which a centrally located web produces. The drill is made of high-speed steel and in a variety of sizes, with both tapered and straight shanks.

Herbert Pendulum Hardness Tester

For the purpose of testing the hardness of substances ranging from lead to sapphire, Edward G. Herbert, Ltd., Chapel St., Levenshulme, Manchester, England, has recently placed on the market the pendulum hardness tester shown in the illustration herewith.

The instrument consists chiefly of a ball 1 mm. in diameter held in a chuck at the center of the device, and six screw-actuated weights which provide a means whereby the center of gravity of the whole instrument may be adjusted to coincide with the center of the ball. Immediately above the ball is a graduated cylindrical weight mounted on a screw. By raising or lowering this weight, the center of gravity of the instrument can be brought to a predetermined distance above or below the center of the ball. The graduations on the weight show displacements of the center of gravity in 0.01 mm. A curved tube containing a bubble, and a scale graduated from 0 to 100 are fixed at the top of the instrument.

Since the center of gravity is at the center of the ball, the instrument is in neutral equilibrium when supported by the ball on a hard level surface. The device tends to remain in any position in which it may be placed, whether upright or tilted at an angle. If the center of gravity is above the center of the ball the equilibrium is unstable, in which case the instrument tends to "lie down" in one direction or another. If the center of gravity is below the center of the ball, the equilibium is stable. The instrument constitutes a pendulum oscillating about its central position, the time of oscillation being greater as the length of the pendulum, on the distance between the center of gravity and the center of the ball is less. For standard tests the length of the pendulum is 0.1 mm. (0.0039 in.), and the time of a single swing on a very hard surface is 10 seconds.

Two entirely independent tests of hardness are provided by the instrument, namely the "scale test" and the "time test." The latter is the general test for hardness, while the former in conjunction with the "time test" may be regarded as a further means of investigating and comparing the properties of various materials.

If the instrument is tilted to the right until the bubble comes to zero on the scale and is placed in that position on a level surface, it will swing in pendulum fashion, the oscillations gradually decreasing in amplitude owing to the expenditure of energy at the point of contact between the ball and surface of the material. And, if the surface is not too hard the ball will indent it, so that as the pendulum swings the ball will roll out or elongate the indentation. The energy absorbed in thus displacing the metal is taken from the potential energy of the pendulum; thus the position of the bubble on the scale at the end of the first swing shows the work done by the ball on the specimen and measures its hardness by the so-called "scale test."

In the "time test" the pendulum is placed gently on the specimen with the bubble at or near 50, and then it is caused to oscillate through a small arc. The time in seconds taken in making ten swings on any substance represents its "time hardness number." The time test is recommended for general use, as it can be easily and quickly performed. When working on very hard substances which are not indented appreciably, the center of gravity can be made zero or brought above the center of the ball, if necessary, thus greatly increasing the sensitiveness.

The instrument is made in two weights, 2 and 4 kg. respectively, the dimensions being identical. The 2 kg. pendulum is used with either ruby or steel balls, the ruby being used to test the whole range of material from lead to sapphire, while the steel may be used on material up to and including hardened tool steels. Steel balls only are used with the 4 kg. pendulum. The pendulum is 12 in. long and will span flat surfaces 6 in. wide or cylindrical specimens 8 in. in diameter.

HERBERT PENDULUM HARDNESS TESTER

Either instrument is furnished with the following equipment: A levelling table to support flat specimens; a universal ball vise, with locking device and levelling screws to hold irregular and cylindrical objects; a stop watch; a sensitive spirit level; tweezers; a standard glass plate; and extra balls. The illustration shows the ball vise in use holding a milling cutter for testing.

Niles-Bement-Pond Locomotive Frame Slotter

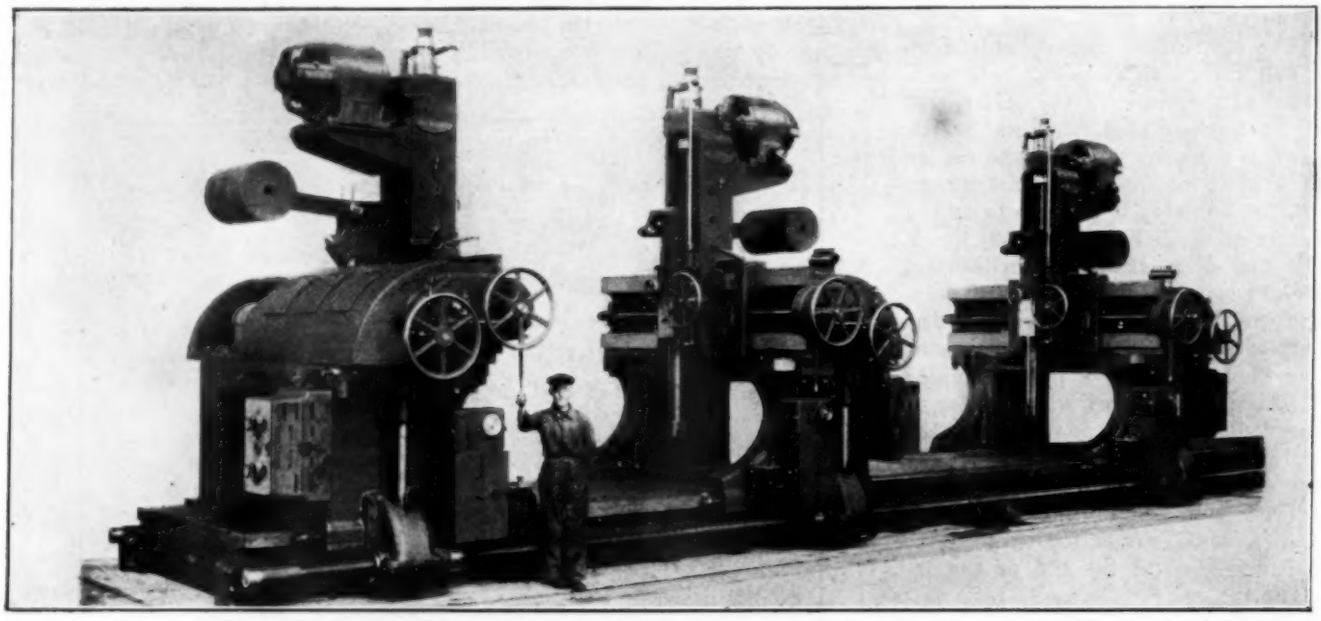
The Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. has recently placed on the market a locomotive frame slotter, the chief feature of which is the method used for the main drive of each unit. The former method of securing the reversing motion by means of either a crank and connecting rod or the use of reversing pulleys and belts for transmitting power to a rack on the cutter bar, has been replaced by the use of a reversing motor mounted on each head, which motor, driving through one pair of gears only, rotates a vertical screw that directly engages the cutter bar.

Motors of 20 hp. are employed, each with a 4-to-1 speed range. The cutting and return speeds are controlled independently, any combination being obtainable within the speed ranges of the motor. All return speed ranges are much higher than those for cutting. Two dials on the contactor panel are connected with the rheostats which govern these two speed functions, the desired cutting speed being set on one dial and the return speed on the other. The motor is reversed by automatic contactors governed by a pilot switch, which is actuated by the tripping of adjustable dogs on the cutter bar. These dogs are set by hand at locations that give the desired length and location of stroke, the maximum stroke being 38 inches.

Another feature of the machine is found in the feed arrangements employed. Each head has its own motor for feeding and traversing the head along the bed and the saddle along the crossrail. This motor by means of gears and shafts engages with and revolves nuts on fixed screws along each side of the bed for the longitudinal feed and traverse of the head. The same motor is used for feeding and traversing the saddle along the crossrail by means of another gear train. Both feed and traverse controls and operations are performed electrically. A dial set at the desired point allows the feed motor to make one or more revolutions intermittently, by means of which the desired feed is obtained. The throwing of a switch allows the motor to run continuously, giving fast traverse of either the head or saddle.

Slotting at an angle too steep to be covered by the swiveling feature of the crossrails is necessary at the ends of some locomotive frames, and this requirement is met by combining longitudinal and cross-feeds for simultaneous action. By means of change gears and swing arms, combinations between these feeds may be effected, to slot any angle up to and including 145 degrees.

These slotters are built with from one to three heads and in any desired length of bed. The machine illustrated herewith has a bed length of 60 ft. Each head is self-contained and independent in every way. The head comprises two principal members, the yoke and the crossrail, the latter being swiveled in the horizontal plane when cutting tapers and angles. The openings in the yoke are 61 in. wide and 41 in. high, and accommodate six 6-in. frames or four 8-in. frames set on the bed for simultaneous slotting. A cylindrical extension tool bar is used, which has a relief socket on the tool apron and has its upper bearing in the cutter bar. To set the tools or cut fillets, the tool bar is revolved by means of wormwheel gearing and hand wheels.



NILES-BEMENT-POND LOCOMOTIVE FRAME SLOTTER

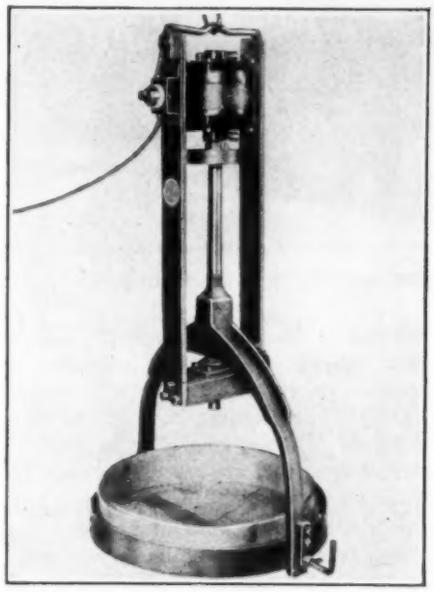
Lowe Electric-Driven Sifting Machine

The Lowe Manufacturing Co., 6063 Wabash Ave., Detroit, Mich., has recently placed on the market a portable electric-driven sifting machine, shown in the accompanying illustration, for use in the foundry operation of screening core and molding sand.

A ½-hp. G. E. motor of either a.c. or d.c. type and 110 or 220-volt capacity is employed; it is fully enclosed at the top of the machine and away from the riddle. It is bolted to the 1 x 3-in. steel side bars, which are set 8 in. apart, and is so constructed that it is not affected by the dust, fumes and heat encountered in actual operation in commercial foundries.

The flywheel into which the motor shaft is fitted runs on the same center as the latter and has a double row of Hess-Bright ball bearings on its lower side which are ⅛ in. off center and hold the upper end of the main shaft. A 2-in. ball totally enclosed and fitted into the solid connecting bar of the frame supports the lower end of the main shaft 20 in. below the flywheel. Just above this supporting ball the iron riddle yoke is welded to the shaft, extending downward 15½ in. and allowing a 14-in. clearance over the riddle for shoveling. The ball bearings and the supporting ball are fully enclosed.

When the riddle is in operation the upper end of the main shaft turns in a circular path ¼ in. off center, the motor shaft being centered. Thus the main shaft forms a cone of revolution with its apex at the neutral point 20 in. below. The riddle yoke, welded to the main shaft just above this apex, forms another cone of revolution with its apex inverted to that of the main shaft. A leather-faced bracket bolted to one of the side bars at the lower end, serves as a check to prevent the riddle yoke from rotating when the machine is started. The result is a steady motion of 1,725 gyrations per minute on a 20-in. wooden-rim riddle. The riddle is clamped in position by a single locking wingbolt.

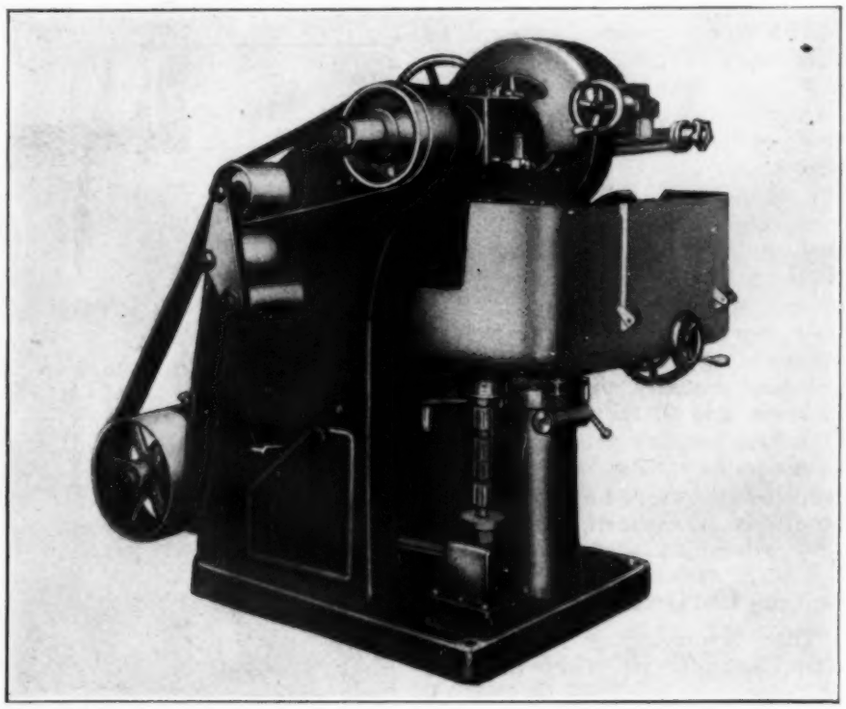


LOWE ELECTRIC-DRIVEN SIFTING MACHINE

The machine weighs 125 lb. and can be suspended from a crane hook, bracket, beam or any other support. It is adjustable as to height to suit the convenience of the workman.

Detroit No. 4B Centerless Grinding Machine

The Detroit Machine Tool Co., 6545 St. Antoine St., Detroit, Mich., has recently added to its line the heavy-duty centerless grinding machine shown in the illustration herewith and incorporating the basic principle of the No. 4 machine described on page 574, Vol. 54, of the *American Machinist*. The machine is known as the No. 4B and is intended for grinding straight cylindrical parts such as piston rings, gear and governor shafts, rubber or fiber rods, drill rods and valve parts, on a high production basis.



DETROIT NO. 4B CENTERLESS GRINDING MACHINE

As in the former type, two abrasive wheels are used, the upper for grinding and the lower for rotating and feeding the work. The feed wheel is double the width of the grinding wheel, so that the work is already rotating at the proper speed as it comes in contact with the grinding wheel. The lower wheel is mounted on a vertical column about which it may be pivoted to vary its angle with the grinding wheel any amount up to 10 deg., thus changing the traverse speed of the work through the machine. Control of the cut of the grinding wheel is obtained by raising or lowering the entire feed wheel unit, thus altering the distance between the wheels. This movement is accomplished by means of a handwheel operating a worm and wheel, which in turn operate a jack screw in the column. A dial attached to the handwheel reads in 0.0001 inches.

By means of sliding change gears, the change gear box provides two grinding wheel and two driving wheel speeds. The main drive pulley of 12 in. diameter and 6 in. face runs at 750 r.p.m., giving grinding wheel speeds of 1,080 and 1,176 r.p.m. and driving wheel speeds of 33 and 44 r.p.m. The 9x8 in. feed wheel is driven direct from the change gear box by means of gears and shafts. Backlash in the feed wheel is prevented by a worm and wormwheel drive on the spindle itself, with a device to compensate for wear. The 18x4 in. grinding wheel is driven by a belt running from the change gear box pulley and over a ball bearing idler to the grinding spindle pulley.

A feature of the grinding wheel drive is the method used for connecting the spindle and spindle pulley. The ball bearing pulley is mounted on a stud, which is supported at the outside end by a cast-iron bracket. The inner side of the pulley carries a plate with a splined bore which engages with the splined end of the

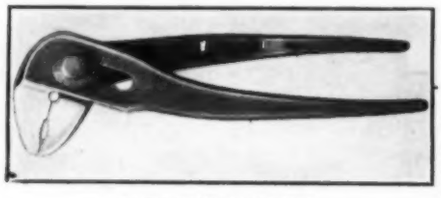
spindle. This flexible coupling is claimed to eliminate friction on the spindle bearings due to belt pull and to increase the power available for grinding.

Diamond truing devices are integral parts of the machine, and are mounted in place on the machine ready for use. A 40-gal. tank that holds the grinding solution is cast integral with the base of the machine and on it is located a centrifugal pump, which is driven by a pulley on the main drive shaft and pumps the solution directly on the work as it is being ground.

Either belt or motor drive can be furnished. For silent chain drive a chain of $\frac{3}{8}$ in. pitch and $2\frac{1}{2}$ in. width is recommended, with the number of teeth on the motor and machine sprockets, respectively, 25 and 39, the normal center distance between sprockets 16 in. and the total adjustment on the sliding base 1 in. A 10-hp., 1,200 r.p.m. motor is required. The machine occupies a floor space of 69 x 54 in., weighs approximately 5,000 lb. and has a grinding capacity up to 4 in. in diameter and 16 ft. in length. For diameters smaller than $\frac{1}{2}$ in. thin work guide blades are required, while lengths over 4 or 5 ft. usually require work supporting devices.

Carlson Pliers

The accompanying illustration shows drop-forged pliers that are being manufactured by the Noble & Westbrook Manufacturing Co., Hartford, Conn. The tool is adjustable to different sizes of pipes, bolts, nuts, caps and nipples and is especially adapted for tightening or loosening



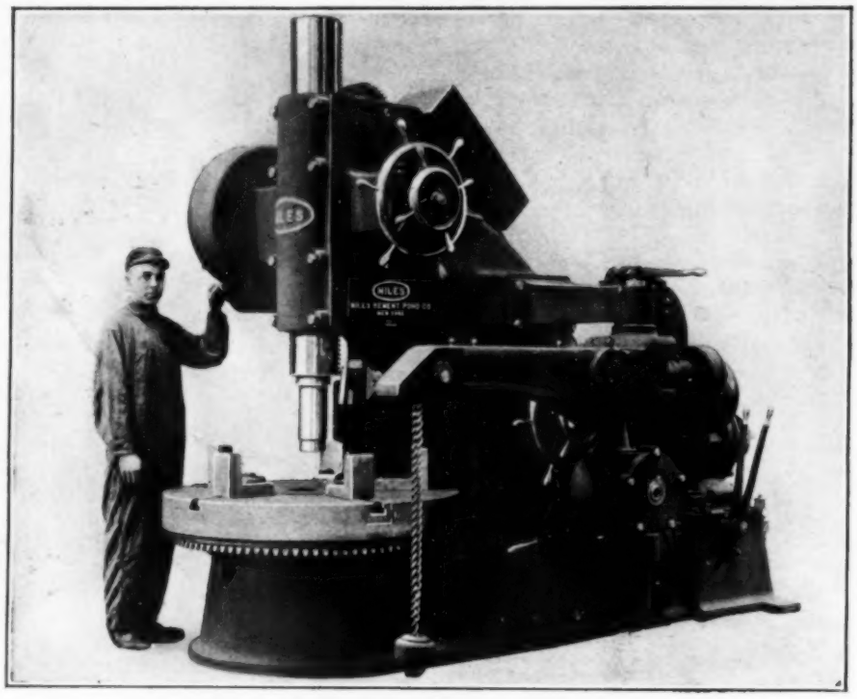
CARLSON PLIERS

such parts when they are concealed in corners or in close quarters. The jaws are set at an angle to the handles, in the manner shown in the illustration.

The capacity of the pliers ranges up to 1 in. on square and $1\frac{1}{4}$ in. on round material. All parts are machined, heat-treated and finished. Either a charcoal or gun-metal finish may be had. The device weighs $\frac{3}{4}$ lb. and has a length of 7 inches.

Niles-Bement-Pond 48-Inch Car Wheel Boring Machine

The Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. has recently brought out a 48-in. car wheel boring machine which embodies a number of features tending toward increased production and safety. The frame of the machine, which is shown herewith, has been made heavier for greater rigidity and its pattern has been altered so as to give more support to the hub-facing bar. In addition to this feature, an automatic self-centering chuck is employed.



NILES-BEMENT-POND 48-INCH CAR WHEEL BORING MACHINE

After the car wheel to be bored has been swung into place by the motor-driven crane supplied with each machine for that purpose, the driving motor is started at slow speed and causes a mechanism in the table to move the chuck jaws inwardly until they engage the wheel tread. When the job is firmly chucked, the table commences to rotate and the driving force which is employed after the cutting operation begins serves to further lock the wheel in the chuck jaws. Upon finishing a job the motor is reversed, and the relative motion between the driving gear and table serves to loosen the jaws and withdraw them toward the periphery of the table, after which the motor is stopped and the car wheel removed by the crane.

The boring bar counterweight operates down an incline on the back of the machine frame and is so arranged that in the event that the support chain breaks, the counterweight will not fall.

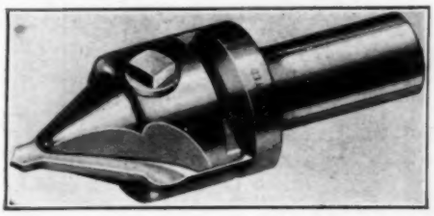
For either direct or alternating current, the machine uses reversing motors. The table speeds are obtained by employing a variable-speed motor in the case of direct current, and a constant-speed slip-ring motor operating through a speed change box where alternating current is used. No clutches are used in either case. Dynamic braking can be taken advantage of where a shop utilizes direct current. A belt-drive may be furnished but it is not recommended, as it eliminates the advantages derived from the economical power consumption, dynamic braking and reversing motor, as well as the utilization of a motor for operating the small crane.

Wagner Inserted-Blade Center Drill, Reamer and Countersink

A device that does in only one operation the three operations in centering work, namely, drilling, reaming and countersinking, has re-

cently been developed by the Frederick A. Wagner Co., Inc., Rochester, N. Y. The tool, which is shown in the accompanying illustration, has an inserted blade or cutting member.

This tool has a casehardened mild steel body or holder, which is slotted



WAGNER INSERTED-BLADE CENTER DRILL, REAMER AND COUNTERSINK

to receive the blade. Two 30-deg. beveled edges on the bottom edge of the blade are used as a means of centering the latter in the holder, the beveled edges and the hole in the center of the blade giving three points of support to insure that the blade is centered in the holder.

Four sizes of blades are available, for centering shafts from $\frac{5}{8}$ to 10 in. in diameter, the smallest blade centering shafts from $\frac{5}{8}$ to $1\frac{1}{2}$ in. in diameter and the largest from $6\frac{1}{4}$ to 10 in. The blades are made of tungsten alloy steel and are blanked out with dies. The cutting lip and the drill point of each blade are hot forged in a die, and then the blade is hardened and tempered. The flat sides are ground with the blades held on magnetic chucks, and lastly the radial relief, cutting edges and drill point are ground.

Cleveland No. 2 Pyramid-Type Bending Roll

The accompanying illustration shows a pyramid-type bending roll recently placed on the market by the Cleveland Punch & Shear Works Co., Cleveland, Ohio.

The machine has a space between housings of 10 ft. 2 in., and is directly connected to a motor so as to be entirely self-contained. This motor, as well as driving the rolls, is also arranged to provide power to lower and raise the top roll, which is 11 in. in diameter. One of the lower rolls, which are 8 in. in diameter, has three splines, while the other has two splines and a flanging groove.

A feature of the machine is that none of the gears protrude into the foundation to require the addition of a pit. Two clutches are provided so that either end of the top roll may be raised and lowered. An additional single clutch is used for starting the rolls. The outer drop hinge can be readily dropped by simply lifting the cover plate from the shoulder bolts and dropping the yoke, as shown in Fig. 2. This is merely a one-man

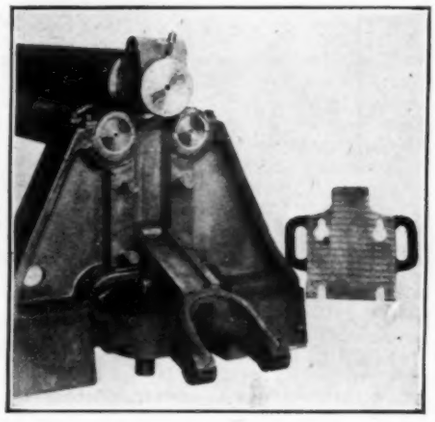


FIG. 2—DROP HINGE ON TOP ROLL

job. The roll can then be tilted by the pressure of the screw on the extended end of it at the left, thus enabling complete cylinders to be easily removed. The power drive for this motion enables rapid operation.

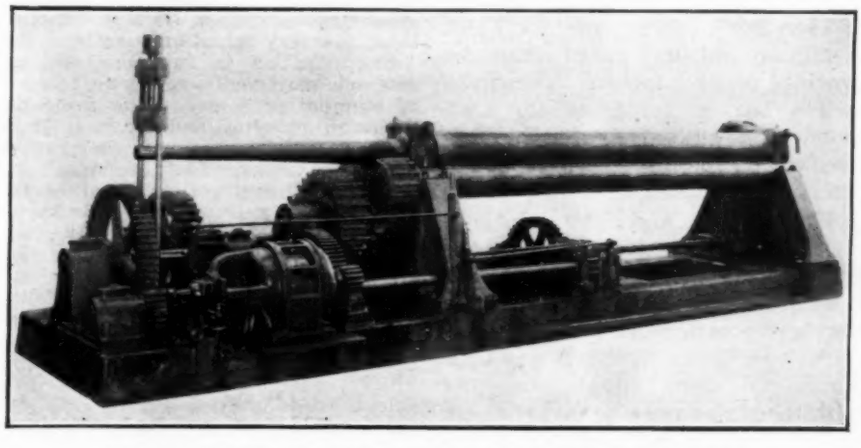


FIG. 1—CLEVELAND NO. 2 PYRAMID-TYPE BENDING ROLL

"Cleveland" Universal Drill Jig

By changing either the bushings in one type or the top plate in the other, many different parts may be drilled in the two types of universal drill jigs that have been recently placed on the market by the Cleveland Universal Jig Co., 2005 Oregon Ave., Cleveland, Ohio.

Type A, which is illustrated in Fig. 1, takes the place of a screw

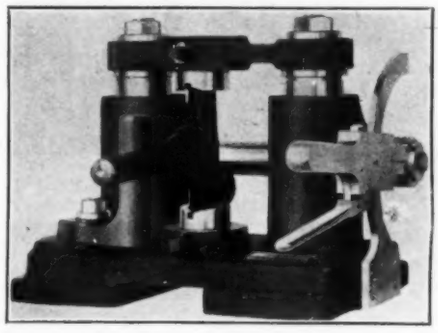


FIG. 1—"CLEVELAND" UNIVERSAL TYPE A DRILL JIG

bushing type of jig. It consists of a base with two columns in which are two plungers that hold a top plate spanning from one column to the other. This top plate is bored in line with the base to receive the drill bushings. By means of racks and pinions the plungers can be operated up and down, the pinion shaft being actuated by the handle, which can be positively locked in any position on the sector by pressing the handle latch, thereby causing a wedge to be pulled down and forcing a shoe to clamp the sector. The drill bushings are removable and can be made to conform to any shape of work whether round or irregular, since only straight up and down movements are required to use the jig.

The leg and box type of jig is replaced by the Type B jig shown set up to drill the bolt holes in a bell-shaped casting in Fig. 2. In construction this jig consists of a square base in which posts are fastened at each corner. To these posts a top plate is attached, which is bored to receive drill bushings. The same handle and rack and pinion movement is used as in Type A, but instead of two plungers moving down with the movement of the handle, there is only one plunger moving up. This plunger holds the work against the top plate while drilling.

Loading and unloading operations are done with a minimum number of

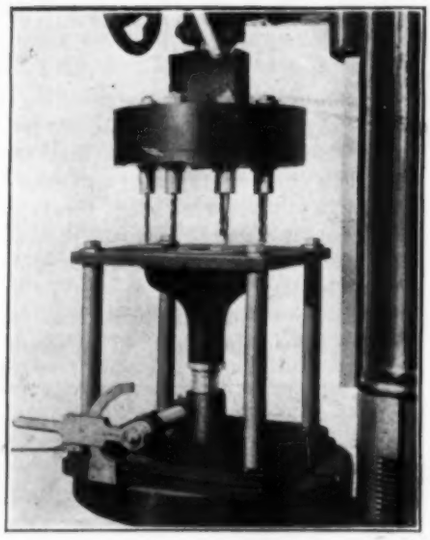


FIG. 2—TYPE B DRILL JIG

simple motions. The work is placed in the jig, the handle pulled down so that the work is held rigidly between the bushings or against the top plate, and then the handle latch is pressed to hold the work in that position. To unload, the handle latch is pushed down, the handle raised and the work removed.

Harris No. 815 Motor-Driven Full Automatic Hob Sharpening Machine

An improved motor-drive, together with a hand wheel adjustment for both the vertical and horizontal positioning of the grinding wheel has been installed on the No. 815 motor-driven automatic hob grinding machine described and illustrated on page 190, Vol. 56, of the *American Machinist*. The machine is manufactured by the Harris Engineering Co., Bridgeport, Conn.

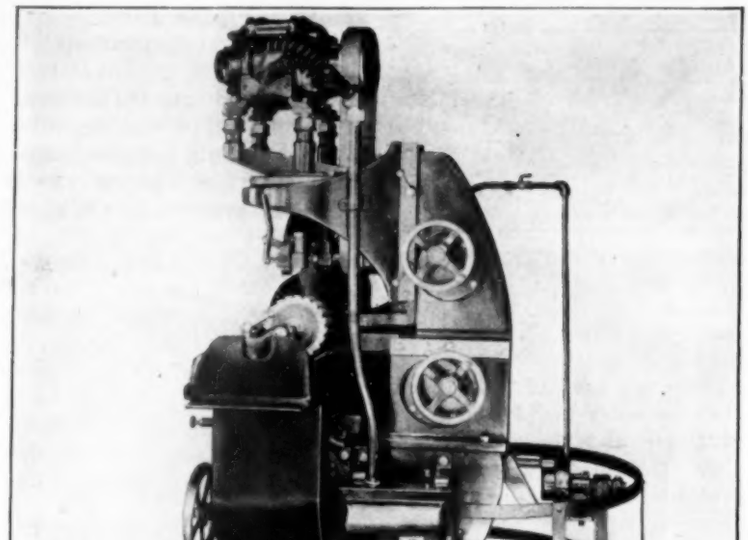
The drive arrangement consists of a General Electric motor, mounted as shown at the top of the machine, on the turntable which carries the wheelhead. Being mounted thus upon the turntable, the entire motor may be swung to the required angle together with the grinding wheel and diamond truing device when grinding either right- or left-hand spirally fluted hobs, or it may be swung to the zero position when grinding straight-fluted hobs. The grinding wheel is driven by means of a belt, the slack in which can be taken up by raising the motor.

By means of cap screws, the motor is fastened to four square-headed adjusting screws. These screws can be clamped rigidly in tapped holes in the brackets by locknuts. To adjust the motor to take up slack, the four holding cap screws are slightly loosened, as are also the locknuts, and each one of the supporting screws is turned the same number of quarter turns, as indicated by their square heads, until the belt is tightened sufficiently. The locknuts are then tightened, so that the motor is held rigidly.

A motor is mounted on a bracket at the rear of the machine, as can be seen, which serves to drive the table reverse mechanism, the index mechanism and the spiral generating device, as well as the pump. Either an open guard, as shown, or a sheet metal or netting guard may be provided for this motor. A separate switch box is furnished for each motor and all wiring for both is mounted on the machine so as not to interfere with the operator.

The vertical and lateral adjustments of the wheel slide have been changed on this machine so that instead of the ball crank handles previously used, hand wheels provide sensitive adjustment by means of a worm and worm wheel connecting with the pinion running into the rack on the movable members.

The machine may also be furnished for belt drive, being supplied in this case with a countershaft having an automatic take-up and tightening device for the belt that drives the wheel spindle. A jackshaft is also used in this drive which is so arranged at the top of the turntable that the latter may be swiveled to any required angle.



HARRIS No. 815 MOTOR-DRIVEN FULL AUTOMATIC HOB SHARPENING MACHINE

Calls Simplification a Waste Eliminator

There is and has been considerable confusion as to the real significance of simplification as differentiated from standardization, states a pamphlet prepared by the United States Chamber of Commerce. To many the two are synonymous, but in actual practice there is a very definite distinction.

Simplification is fundamentally an economic movement—a very real means of eliminating some of the avoidable waste in industry and trade. It is based on commercial expediency rather than on scientific fact; technical research and engineering experimentation are not necessary. This statement is not meant to imply that simplification is hit and miss or arrived at through "grab bag" procedure. Quite the contrary is true. Simplification is developed from the best practice and judgment of an industry or individual establishment. Facts are vitally necessary, but production and sales records coupled with a true picture of the consumers' needs is usually sufficient for constructive simplification action and procedure.

News Section

Twelve-Hour Day for Steel Mills Says Special Committee's Report

DECLARING that the twelve-hour work day for steel mills was imperative to the welfare of the country and that the eight-hour day would not only work a hardship on the employers and employees, but on the world at large, Judge Elbert H. Gary, chairman of the board of the United States Steel Corp., delivered the report of the special committee to the members of the American Iron and Steel Institute who were gathered at the annual conference held at the Hotel Commodore on May 25. The report was well received by the steel men present.

The special committee which was appointed some time ago has been considering the work hour question and only a few days before Judge Gary delivered the findings, he held a conference with President Harding at Washington at which time the subject was discussed. President Harding, who is much in favor of the eight-hour work day expressed his disappointment when informed of the text of the report which was substantially as follows:

"Apparently the underlying reason for the agitation which resulted in the appointment of this committee was based on a sentiment, not created or indorsed by the workmen themselves, that the twelve-hour day was an unreasonable hardship upon the employees who were connected with it; that it was physically injurious to a large percentage of the employees, and that it interfered with family associations essential to the welfare of the children; that for these reasons it was, in a sense, opposed to the public interest.

Benefits of Longer Day

"Whatever will be said against the twelve-hour day in the steel industry, investigation has convinced this committee that the same has not of itself been an injury to the employees, physically, mentally, or morally. Whether or not in the large majority of cases twelve-hour-day men devote less time to their families than the employees working less hours is perhaps questionable.

"Because the steel industry is largely a continuous process, there must be three eight-hour shifts or two twelve-hour shifts, the committee believes. The workmen, as a rule prefer the longer shift because it means more pay they find. And 'there is less physical work, as a total per day, and less fatigue from the work of a twelve-hour day in the steel industry than pertains to the large majority of eight-hour men.'"

Judge Gary, who is president of the American Iron and Steel Institute, also delivered his annual address. He has recently returned from a Mediterranean cruise and was much impressed with the various sights in the Holy Land. He declared that Christianity should be brought closer to business and that with the complete entrance of Christian principles into business, greater happiness would be the result.

Mr. Gary reserved his customary analysis of conditions in the steel industry for the end of his address, when he asserted, optimistically, that "there is nothing in sight to indicate that there will be a substantial diminution of the demand for finished steel in this country during the next six months, to say the least." He warned steel manufacturers, however, not to permit prices to go above the level which is "fair and reasonable."

Excellent Papers

Many excellent technical and semi-technical papers held the interest of those attending during both the morning and the afternoon sessions. "Laying of High Power Submarine Cables in San Francisco Bay," a moving picture furnished by the American Steel & Wire Co., Worcester, Mass., opened the program and was thoroughly enjoyed. The following speakers and their topics were on the program: "The Value of Chemistry in the Iron and Steel industry," W. A. Forbes, United States Steel Corp., New York; "A Motor Driven Rolling Mill," H. E. Davis, Chief Electrician, Interstate Iron & Steel Co., South Chicago, Ill.; "The Standardization of Steel Mill Practice Through Time Study," Robert Gregg, president, Atlantic Steel Co., Atlanta, Ga.; "Gas Producer Practice in Steel Works," Waldemar Dyrssen, United States Steel Corp., New York; "Waste in Steel Industry," H. T. Morris, Metallurgical Engineer, Bethlehem Steel Corp., Bethlehem, Pa., and "The Disintegration of Fire Brick Linings in Iron Blast Furnaces," C. E. Nesbitt and M. L. Bell, Research Engineers, Carnegie Steel Co., Pittsburgh.

Luncheon was served in the Grand Ball Room at noon and in the evening a banquet was held. This is the twenty-third annual meeting of the Institute.

Electric Steel Founders Hold Meeting

The Electric Steel Founders' research group held a meeting of executives at Wernersville, Pa., on May 14 to May 17. The various phases of the research work being done by the members of the group, to improve the quality of steel casting and increase efficiency in methods, were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing sand mixtures, core sand mixtures, electric furnace practice and kindred subjects.

Trade Schools Discussed in Connecticut

The spring meeting of the Schoolmasters' Round Table of Southwestern Connecticut was held recently at Stamford, Conn. H. J. Hanson, of Bridgeport, spoke at some length on the value of the co-operative course in the trade school. He illustrated his remarks by a number of hand paintings graphically showing the work of the skilled and unskilled man. He said that the aim of the trade school is to offer to young men over fourteen years of age such training and experiences as will fit them to become "all round" mechanics in their particular trades; and will also permit of their advancement to such supervisory positions as their personal qualifications may warrant.

This aim is accomplished by giving the boy experience on actual jobs of commercial character, under usual shop conditions as to tools and machinery and at the same time by thoroughly training him in mathematics, drafting and science that will be of service to him as a tradesman or supervisor, he stated. The boy is advanced from operation to operation as rapidly as he is able to acquire the skill involved and is not kept on any job for the sake of production. He is thereby offered a very wide range of experience during his apprenticeship.

Between 4,800 to 5,400 hours are required to give the apprentice the training and experience offered by the school, according to the amount of general education he may elect to receive. Other speakers were also heard and enjoyed.

W. G. Stephens, director of the State Trade School at Stamford was also an interesting speaker. He outlined the work at the school and the hopes for its future success as well as the co-operation between the school and employers.

F. A. E. S. Names Committee For Coal Probe

Announcement of personnel and plans of the committee which is to direct a national investigation of the storage of coal in co-operation with the U. S. Coal Commission, the Department of Commerce and the Bureau of Mines, is made by the Federated American Engineering Societies. The committee members are:

H. Foster Bain, Director of the U. S. Bureau of Mines, Washington; David Moffat Myers, former Fuel Administrator, New York; Perley F. Walker, dean of engineering, University of Kansas; W. H. Hoyt, chief engineer of the Duluth, Missabe and Northern Railway, Duluth, Minn.; S. W. Parr, professor of applied chemistry, University of Illinois; Edgar S. Nethercut, secretary of the Western Society of Engineers, Chicago; Roy V. Wright, editor, New York. The chairman is W. L. Abbott, chief operating engineer of the Commonwealth Edison Co. of Chicago.

Arnold Turner Victim of Apoplexy

Arnold Turner, treasurer of the Turner Machine Co., Danbury, Conn., died recently at his home in that city as the result of a stroke of apoplexy. Mr. Turner was born in England and

ARNOLD TURNER

came to this country in 1893 when he became established with the manufacturing company that has been established in Danbury by his father as a branch of an English hat machinery manufacturing plant. He was 50 years of age.

Cincinnati Business is Reported Steady

Machine tool houses in Cincinnati are turning out about the same volume of production as they were during the early part of May. The increase in business which had slowly come about since the first of the year was retarded somewhat by a lull in orders which lowered the volume of sales throughout the early part of May. This condition still exists, although not to quite as large an extent. Purchasers in many instances are holding off placing their orders and seem to be reluctant to make any purchases except those which are absolutely required through sheer necessity, most of which are replacements rather than added equipment.

One of the encouraging signs is the amount of material being bought by railroads. A number of large sales to various railroad lines has been made in the past two weeks. In fact several of the largest machine tool companies have not been affected by the decrease in the number of orders which has been experienced by other concerns throughout the city. Another encouraging feature of the situation in the Cincinnati market is the fact that there have been a great many inquiries in the last few weeks and sales departments of machine tool firms report that they expect to close considerable business in the immediate future.

The demand for machinery from the automotive industry has held up splendidly. This has been a big factor in keeping the production of many plants up to the scale which prevailed during March and April. Milling machines and grinding machines are in fair demand while orders for production milling machines are excellent. The sales of planers are about the same as they have been for several months with buyers insisting upon quick delivery. Large manufacturers of lathes say that orders have increased in the last seven days.

The electrical tool houses have been busy with a slight falling off in orders noticeable during the past two weeks. Both electric and radial drilling machines are selling well.

Most machine tool manufacturers in Cincinnati look with confidence and optimism on the prospects for June business. It is anticipated that the purchases by the automotive industry and the railroads will continue unabated and that the orders from other fields will show an increase. The foreign business being done by Cincinnati concerns maintains about the same volume that it has since the first of the year. There is some business in the Far East which is proving to be of value while orders from South America have been fair. The demand from Europe is a negligible factor in the local market.

Car Shortage Lessens in Face of Big Demand

Despite the fact that the number of freight cars loaded with revenue freight is now the largest for this time of year in the history of the railroads, shortage in freight cars has virtually disappeared, according to reports just filed by the carriers with the Car Service Division.

Shortage in freight cars for the country as a whole on May 14 totaled 23,761, which was a decrease of 4,555 since May 7. Compared with the car shortage on Jan. 1, 1923, this is a decrease of nearly 60,000 cars, while since April 1 this year, there has been a decrease of more than 45,000. This gradual decrease in the car shortage has taken place in the face of a consistent increase in loadings.

Shortage in box cars on May 14 amounted to only 5,528, which was a reduction of 3,641 in a week, while there also was a reduction of 1,019 in the shortage in coal cars which reduced the total to 15,653 for the entire country.

With the reduction in car shortage, there is a gradual increase in the total numbe rof surplus freight cars in good repair.

Condition of Cars Shown in Report

Class I steam roads are required to make sworn monthly reports of operating statistics to the Interstate Commerce Commission. The following summary of the condition of cars and locomotives is taken from these reports and presents an interesting study for manufacturers.

CLASS I STEAM ROADS IN THE UNITED STATES

Month	Per Cent of Freight Cars Unserviceable*			Per Cent of Locomotives Unserviceable* — Road Freight			Per Cent of Locomotives Unserviceable* — Road Passenger		
	1921	1922	1923	1921	1922	1923	1921	1922	1923
January	8.8	13.6	9.0	25.2	24.0	26.1	24.1	22.5	24.4
February	9.8	14.0	8.8	25.2	24.1	25.0	24.0	22.8	24.2
March	10.8	13.8	8.8	23.8	23.8	24.6	23.7	22.5	23.8
April	12.3	13.6	....	23.9	23.8	....	23.9	22.2	....
May	13.6	14.1	....	24.0	23.2	....	23.5	21.9	....
June	14.4	13.9	....	23.6	21.9	....	22.5	20.6	....
July	15.4	14.2	....	24.0	25.2	....	22.5	21.9	....
August	15.5	14.0	....	23.8	29.1	....	22.6	24.8	....
September	15.5	12.6	....	23.5	29.9	....	22.6	26.8	....
October	14.8	11.3	....	23.2	28.0	....	22.9	26.6	....
November	13.8	9.8	....	23.8	26.9	....	22.8	25.7	....
December	13.0	9.1	....	23.9	26.4	....	21.7	24.3	....

* The term, unserviceable cars, includes cars in or awaiting shops and bad-order cars at outlying points. The term, unserviceable locomotives, includes locomotives awaiting or undergoing repairs if held more than twenty four hours on that account, as well as unserviceable locomotives stored or awaiting sale.

The corresponding data for individual railroads are available to the public in the reference room of the commission, Bureau of Statistics, and also in the monthly summaries of operating statistics for roads having annual operating revenues over $25,000,000. The reports are recognized as authentic and are used by many shippers to great advantage.

Unofficial advance information as to condition of equipment is compiled and published by the car service division of the American Railway Association. Because of difference in method of reporting, these reports do not agree exactly with the final sworn reports made to the commission, but show a similar trend.

The following data are included here as a matter of information from these unofficial reports:

Date	Per Cent of Freight Cars Unserviceable	Per Cent of Locomotives Unserviceable — Road Freight	Road Passenger	Switching
1922				
June 1	15.0	20.4	19.8	17.0
June 15	14.6	20.8	20.1	17.6
July 1	14.3	18.4	17.0	16.4
July 15	15.1	20.1	18.3	17.2
August 1	15.3	24.6	20.7	19.6
August 15	14.8	26.1	21.8	20.4
September 1	14.1	27.7	23.8	21.1
September 15	13.4	27.9	24.6	21.9
October 1	12.8	27.0	25.1	21.6
October 15	11.9	26.7	24.5	20.6
November 1	11.0	25.0	24.2	19.1
November 15	10.4	24.9	24.2	19.4
December 1	9.9	24.0	23.0	18.0
December 15	9.4	24.2	22.9	18.1
1923				
January 1	9.5	23.0	21.1	16.7
January 15	9.6	23.7	22.3	17.8
February 1	9.2	22.4	21.5	17.3
February 15	9.1	22.5	22.1	17.5
March 1	9.5	22.0	21.7	17.3
March 15	9.3	22.8	22.5	17.9
April 1	9.0	21.1	20.5	16.1
April 15	9.4	21.6	21.5	16.8

Railroads Good Buyers in Chicago

This week brought evidence that the recent wave of pessimism on the country's future business has been ill considered and exaggerated. The weekly report of the country's freight movement surprised even railroad men. It proved that purchasing in general is of large volume and that goods are going steadily into distribution.

The situation as to machine tool sales in the Chicago district has not materially changed. Several concerns report that railroads are doing about thirty per cent of the purchasing of machine tools. Commercial purchases continue to be mainly single orders.

The oil fields in Texas, Louisiana, and Oklahoma have made machine tool purchases in Chicago recently.

The Santa Fe has purchased eight lathes recently and a 20-ton locomotive crane, the latter from Browning Co., but they have not closed on balance of the large list sent out. The Southern Ry. has prepared an inquiry for its machine tool requirements, the Lehigh Valley is inquiring for one 30-ton electric crane, the Norfolk & Western is in the market for two 150-ton erecting shop cranes, two 18-in. x 8-ft. geared-head engine lathes, four locomotive dome facing machines, one 20-in. x 5-ft. engine lathe, one crank pin turning machine and one 6-in. boring machine.

The Burlington R.R. has placed an order with the Whiting Corp. for a 25-ton electric traveling crane for its Beardstown, Ill. shops. The Atlantic Coast Line has purchased two 100-ton locomotive hoists and one 80-ton coast hoist from the Whiting Corp. The Pennsylvania Ry. has ordered a 30-ton locomotive crane from the McMyler Interstate Co. and the Big Four has purchased a 20-ton locomotive crane from Browning Co. The Southern Pacific has ordered three 25-ton locomotive cranes one each from the Browning Co., the McMyler Interstate Co. and the Industrial Works. The Denver & Rio Grande Western R.R. has ordered four 120-ton, six 15-ton and four 10-ton electric traveling cranes from the Whiting Corporation.

Winton and Haynes in Proposed Merger

Directors of the Winton Co. of Cleveland, automobile manufacturers, have called a meeting of stockholders for June 4 to consider a plan to consolidate the Winton Co. with the Haynes Automobile Co. it was learned recently. The Haynes Co.'s directors have approved the plan, which includes, in addition to the Winton Co., the Dorris Motor Car Co. of St. Louis. The company would be called the Consolidated Motors, Incorporated.

Boston Gets Next Foreign Trade Convention

New England is to be the host of the next National Foreign Trade Convention, according to James A. Farrell, chairman of the National Foreign Trade Council, and president of the United States Steel Corp. The meeting will probably be held during May, 1924, in Boston.

Frank E. Wing Dies After Long Illness

FRANK E. WING, treasurer of the L. S. Starrett Co., of Athol, Mass., died at his home in that city on May 13, after a long illness. Although for some time failing health had made it increasingly difficult for him to attend to the duties of his office, he insisted on continuing his work up to within a very short time of his death.

Mr. Wing, who was fifty-seven years of age at the time of his death, was born in Conway, Mass., and was the son of Edward Everett and Helen Jane Wing.

Mr. Wing attended the public schools of Conway and then Smith Academy, Hatfield, Mass., from which he was

FRANK E. WING

graduated in 1882. He entered Yale in the fall of that year and was graduated with degree of B.A. in the class of 1886. He was honored by his class by being chosen Fence Orator and also Class Historian. He also won the distinguished honor of being chosen chairman of the editorial board of the *Yale Courant*, one of the leading college periodicals. His college fraternity was Psi Upsilon.

He came to Athol in April, 1887, and was employed by the late Laroy S. Starrett as bookkeeper and clerk. He also at that time, attended to all of the correspondence. When the L. S. Starrett Co. was incorporated in 1900, he was chosen clerk and a director, which offices he continued to hold in that well known organization. Since 1912 he had also been treasurer. Mr. Wing was trustee of the Athol Savings Bank, a member and clerk of the Second Unitarian Society in Athol, and for a number of years was chairman of the Athol School Committe and a Library Trustee. He was a member of many fraternal organizations.

Mr. Wing was married in Athol on Sept. 23, 1892 to Miss Edith Mary Smith, who with a son, Donald Goddard Wing, survive him.

Editors to Aid Hoover on Domestic Bureau

On Monday, May 21, the members of the National Conference of Business Paper Editors journeyed to Washington for their regular dinner with Secretary Hoover. They were the guests of John Hays Hammond at luncheon in his beautiful home at 2301 Kalaroma Rd. and listened to his views on the anthracite coal situation. At 3:30 o'clock the usual session with the officials of the Chamber of Commerce of the United States took place in the Chamber board room. Results of the annual meeting were discussed.

At the request of Mr. Hoover, committees were appointed to advise with the Department of Commerce on the organization of a Bureau of Domestic Commerce and on the form and content of a book to cover simplifications, standards and specifications adopted by the Department.

Obituary

ARTHUR J. O'LEARY, one of Chicago's pioneer citizens, father of John W. O'Leary, former president of the National Metal Trades Association, died at his home in Chicago, May 20, after a few days' illness of pneumonia. Mr. O'Leary was in his eighty-seventh year, having been born in Portsmouth, England, on March 25, 1838. He came to Chicago in 1868. In 1875 he established the business of Arthur J. O'Leary & Son Co. which is still operating and of which he was the active head. Mr. O'Leary was well known among members of the National Metal Trades Association.

PROF. HANS GOLDSCHMIDT, inventor of the widely known thermit process for welding iron and steel and for producing high grade metals and alloys, also originator of many other scientific inventions, died suddenly in Baden-Baden, Germany, on May 20, 1923, after a stroke.

Prof. Goldschmidt's most important invention was the thermit process, now used extensively all over the world for welding iron and steel sections, and for producing metals and alloys of high purity.

Prof. Goldschmidt visited this country very frequently and was president of the Goldschmidt Thermit Co., now Metal & Thermit Corp., from 1904 to 1916. Through his death, the world loses a chemist of great knowledge and inventive genius.

PETER WEBER, president and general manager of the Sloan & Chace Manufacturing Co., Ltd., Newark, N. J., died recently at his home, aged 63 years. Mr. Weber had long been connected with the electrical and the machine tool industries, having been identified with the General Electric Co. and the Edison Laboratories before assuming the management of the Sloan & Chace Manufacturing Co.

L. O. KOVEN, senior partner in the firm of L. O. Koven & Brother, Jersey City, N. J., and vice-president and treasurer of the Hoevel Manufacturing Corp., died May 17 in his sixty-third year.

Personals

W. E. BEWLEY, formerly with the sales department in the New York office of the Consolidated Machine Tool Corp. of America, has been transferred to the Chicago office in a similar capacity.

W. H. WEBER, formerly of the Kewanee, Ill., works of the Walworth Mfg. Co., has been appointed superintendent of the iron foundries at Boston, Mass., a plant of the company, and has started in at his new position. Mr. Weber succeeds C. L. SPRAGUE, resigned.

J. E. HART has recently been made superintendent of production of the Walworth Mfg. Co., Boston, Mass.

S. P. HOWELL has been assigned the work in connection with the field investigation of liquid oxygen explosives for the Bureau of Mines.

WALTER B. HOPKINS, for a number of years vice-president of the Thurston Mfg. Co., manufacturer of milling machinery, Providence, R. I., has severed his connection with the concern, taking effect immediately. Mr. Hopkins is succeeded by ROBERT H. SCHAFER, a well known Providence machinery manufacturer.

ROLAND A. HOLMES will be the manager of the new Detroit office in the General Motors Building of the Consolidated Machine Tool Corp. of America, New York.

ROBERT H. GOODELL has resigned as merchandise manager of the Greenfield Tap & Die Corp. and on June 18 will join the Western Electric Co. After a year's preliminary work at the Hawthorne, Ill. plant he is slated for an executive position in the new Kearney, N. J. plant now in course of construction.

W. H. DAMON has been appointed resident engineer of the Railroad Commission of Wisconsin in Milwaukee, succeeding E. J. STEINBERG, who has resigned, effective June 1, to become manager of the Wausau (Wis.) hydro-electric properties of the Wisconsin Valley Power Co. Mr. Damon has been a member of the engineering staff of the commission for ten years, following his graduation from the college of engineering, University of Wisconsin.

HERMAN A. WAGNER, president of the Wisconsin Bridge & Iron Co., Milwaukee, has returned from a business and recreation trip with Mrs. Wagner to Mexico, lasting two months.

MARTIN F. BEARDSLEY, formerly with the Maxwell Motor Co., and the Ford Motor Co., is now plant superintendent for the Wilton Tool Co., 5835 Russell St., Detroit, Mich.

OLIVER WARNECKE, formerly in charge of the planning department of the Maxwell Motor Co., is now assistant plant superintendent for the Wilton Tool Co., 5835 Russell St., Detroit, Mich.

C. G. CASHMAN, who has held various executive positions in the East over a number of years, is now superintendent for the American Grinder Co., Benson St. and Bellevue Ave., Detroit, Mich.

C. M. HALL

C. M. HALL has been appointed Cleveland representative for the Black & Decker Manufacturing Co., Baltimore, Md. Mr. Hall has been with the company for some time and is well known to the trade in Ohio and Indiana, where he has been representing the concern for several years. His new appointment comes in the form of a promotion.

Business Items

The Neilsen-Barton Chuck Co., Chicago, has moved its factory to Lawton, Mich.

The factory structures formerly occupied by the Hess Spring & Axle Co. division of the Standard Parts Co., Cincinnati, were sold at auction for $136,000 on May 24. There are five buildings in the group.

The Precision & Thread Grinder Manufacturing Co., Philadelphia, Pa., announces a twenty per cent reduction on the prices of its improved "1923 Model" precision grinding machine.

The Los Angeles Pump & Supply Co. has moved its shop from 309-311 Los Angeles St. to Eleventh and Wall Sts., Los Angeles, Calif.

The Frederick Pearce Co., New York, has moved its machine shop and factory office to 410-416 East 32nd St., New York City.

The Lyons-Clarke Engineering Co., estimators, buyers, inspectors and shippers, has moved its offices to 411 Penn Ave., Pittsburgh, Pa., due to the necessity for larger quarters.

The Wilton Tool Co., 5835 Russell St., Detroit, Mich., has taken over the manufacture and sale of the Kruce Spiral Expansion Reamer, formerly made by E. J. Kruce & Co., Detroit, Mich. The machinery and equipment of E. J. Kruce & Co. have also been purchased by the Wilton Tool Co., and will be used to augment facilities in its new plant.

The Ex-Cell-O Tool & Manufacturing Co., Detroit, Mich., recently moved from 1214 Beaubien St. to 1469 East Grand Boulevard.

The Suffolk Oilless Bearing Co., Woburn, Mass., has been incorporated under the laws of Massachusetts and has started a factory in that city. The concern will manufacture all kinds of impregnated hardwood oilless bearings. George E. Parker, Jr., is president and Austin H. Welch, treasurer.

An exhibition of devices tending toward safety, health and sanitation will be held in Brooklyn, Oct. 20 to 27. Firms specializing in applications of modern protective devices and methods are eligible to exhibit.

A sale of navy surplus has been announced by the Navy Department. Bids on pressure gages will be received up until June 7 at 11 a.m. Bids on scrap and scrap metals will be received up until June 8 at 11 a.m. at the Central Sales Office, Navy Yard, Washington, D. C.

The Blake & Johnson Co., 1000 Thomaston Ave., Waterbury, Conn., manufacturer of machine screws and machine work, has recently added $480,000 to its outstanding capital stock.

The Van Norman Machine Tool Co. of Springfield, Mass., has made a contract for a term of years with the Franklin Machine & Tool Co. also of that city, by which the first named concern takes charge of the production and sale of machines which have been under manufacture by the Franklin. These include two types of low-priced automobile valve grinding machines which will be manufactured at the Van Norman works in addition to the Van Norman grinding machines, making in all five types of grinding machines to be marketed by the combine arrangement. The Franklin Co. will be continued and retains its freedom to produce any machines not embraced within the terms of the contract.

The Palmer Steel Co., Holyoke, Mass., having outgrown its plant erected in Willimansett last year, is now erecting an addition of 100-foot frontage, at a cost of $10,000.

At the public sale of the assets of the Barton Axle Co. of Barton, Washington County, Wis., the highest bid was $76,000, offered by L. R. Huffmann, motor truck manufacturer, Elkhart, Ind., who intends to use the plant to produce axles for Huffmann trucks as well as the commercial market. The plant was erected three years ago and represents a cost value in excess of $150,000 it is estimated.

Roy Townsend, a member of the defunct Townsend Mfg. Co., Janesville, Wis., is successful bidder for the machinery and equipment, and by an arrangement with the owners of the buildings, will be able to keep the industry intact. Operations will be resumed on a partial scale on June 1, in the manufacture of kerosene and oil engines, tractors and tractor chassis, which comprised the principal line of the defunct concern.

The South Beloit, Wis., foundry purchased recently by the Wanner Malleable Castings Co., Hammond, Ind., from the Stewart-Warner Mfg. Co., Chicago, was reopened May 21 and will be in regular production June 1 with a staff of 150 operatives. The maximum number of employees reached by the former owner was 350, with a daily output of 45 to 50 tons. For the present the plant will be used chiefly for railroad and automobile castings.

By a decision of the United States Circuit Court of Appeals at Chicago, the sale of the assets of the defunct U. S. Auto Gear Shift Co. of Eau Claire, Wis., to B. R. L'Hommedieu of Madison, Wis., for $41,500 is confirmed. The new owner represents a group of Madison capital which will now determine its course of action. A survey is being made to determine if the production of hydraulic gear shifting units for passenger cars will be feasible and profitable. Otherwise the plant will be converted for other uses.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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MOST of us remember the pain in the side that we felt in boyhood when we started to run a race.

In one of his lectures the late William James of Harvard explained that this pain was due to the deep respirations made necessary by unusual exercise. To expand the lungs to the maximum one is compelled to call upon certain muscles in the groin that are not often used because so few habitually breathe up to their full capacity. The result is pain until the unused muscles are "suppled up" when the pain ceases, the "second wind" follows and the boy runs on without discomfort.

Professor James used this story of the runner's physical experiences to give point to his assertion that men do not often work up to their maximum capacity and that when they do more or less distress is felt until by readjustment sustained activity at high speed is made possible and without any pain.

So it has been with American business of late. Until recently it was running at very nearly its maximum speed, but about six weeks ago some pain began to be felt. It was interpreted as an evidence of weakness by certain economic diagnosticians. They proved to be wrong and although they threw the country into a condition of hysteria for a time it is now getting its second wind and a healthy and continued activity is indicated unless the doctors call again and begin to advise caution prematurely.

That they are unlikely to do this is happily to be inferred from the semi-official announcement made by the Advisory Council of the Federal Reserve Board which met in Washington last week. This announcement, though unsigned, says that "a study of conditions throughout the country shows that business is progressively conservative and on a sound basis, and that there are no tendencies calling for a change in the uniform level of 4½ per cent in the Federal Reserve rediscount rates."

Since there seems to be no hope of escape from the tutelage of these self appointed advisers it is at least reassuring to know that they now read the omens favorably and the effect upon the markets was almost electrical.

The bond market, which has been gradually improving under the lead of the Liberty issues, advanced sharply and stocks at once turned upward with railroad shares in the van as had been expected and predicted by those who had noticed the increase earnings and traffic.

There is in fact every reason to believe that "the rails" will soon recover their leadership on the Stock Exchange, for the Interstate Commerce Commission has recently advanced its tentative valuation of the Class I railways from $18,900,000,000 to $21,000,000,000 and it is entirely reasonable to expect that part of this advance should be reflected in the market value of the securities representing these properties, which is now less than 13 billions.

The only stock market groups that are still laggards in the upward movement are the oil stocks, the fertilizer stocks and the stocks of the agricultural implement companies. The last two of these groups still reflect the impecuniosity of the farmer in 1922, and the prices of the oil stocks bespeak an overproduction of petroleum that is good for the consumer, but may not be checked until a legal *modus vivendi* is discovered by the so called Standard Companies and their giant competitors.

> "There is, in fact, every reason to believe that 'the rails' will soon recover their leadership on the Stock Exchange, for the Interstate Commerce Commission has recently advanced its tentative valuation of the Class I railways from $18,900,000,000 to $21,000,000,000 and it is reasonable to expect that part of this advance should be reflected in the market value of the securities representing these properties, which is now less than thirteen billions."

In the commodity markets the effect of the Federal Reserve announcement has been hardly less sensational than in the stock market. Cotton is up nearly two cents a pound, but the advance has been helped by bad crop news and the Agricultural Department's admission that its recently issued bearish reports were in error. The condition of the cotton goods market is well described by a successful merchant who says "I am certain that any accumulation of merchandise is in the warehouses of the mills and their commission agents, and that the jobbers and retailers are and will be in a position in June and July to buy freely for the fall provided prices are satisfactory to them and good crops are indicated."

Wheat and corn, like cotton, are also higher on rumors of crop damage, but it is unlikely that these reports would have had much effect if psychological conditions had not insured their recognition.

Sugar is likewise firmer, with the sugar trade petitioning the President to instruct the Attorney General to drop his injunction proceedings lest by advertising the admitted shortage in the supply a panicky buying movement shall be induced as the canning season commences.

The only direction in which any reaction is to be discerned is in the market for building materials, where the much talked of curtailment of building operation is a somewhat depressing influence. But in considering this curtailment one is impressed by the fact that it has no effect upon the demand for steel, which continues large although copper is weaker at 15⅝ chiefly because Europe is not buying freely.

On this side of the Atlantic the outlook is in fact generally optimistic and when to the foregoing there is added the statement that the Federal Reserve Banks have increased their gold holdings during the week by over $5,000,000 and that the reserve ratio stands at 75.6 per cent as compared with 75.3 per cent a week ago there is but little reason to doubt a further improvement in the tone of business during the summer.

In Europe the outlook is also a little more cheerful. A loan of $130,000,000 is to be made to Austria. Of this $25,000,000 is to be sold here by J. P. Morgan & Co. Under such auspices the success of the issue is assured and it may tempt Germany to propose a settlement of the reparation dispute that England and the United States can help her to consummate. Meantime rioting continues in the Ruhr, the French are sending in more soldiers, Poincaire's popularity seems to be waning and the mark is drifting toward zero. On one day last week it sold at .0017, which means that 10,000 marks could have been bought for 17 cents.

Facing these conditions it would seem that Germany will shortly have to decide between political and financial disintegration or a settlement that the Allies will accept. England seems to be satisfied with Stanley Baldwin as her premier and confident that his administration will be a business success. Another encouraging feature is the announcement that Mexico has undertaken to deal with the arrears of interest on her national debt and that a deposit of the securities will shortly be asked for.

Upon the whole, conditions abroad may be described as negatively optimistic and with the American public now in favor of some sort of international co-operation it is quite possible the news from Europe may soon become affirmatively encouraging.

Ingersoll-Rand Report Shows Increase

The Ingersoll-Rand Co., for the year ended Dec. 31, 1922, reports net earnings of $4,982,948, against $3,062,824 in the previous year. After allowing for depreciation charges, Federal taxes and interest there was reported net income of $3,578,262, which, after allowing for preferred dividends, was equal to $15.71 a share earned on the $21,800,000 common capital stock outstanding, against earnings equal to $3.95 a share on $10,900,035 common stock outstanding in 1921.

News of Washington Activities

By Paul Wooton

SUBSTITUTES for anthracite coal were used with sufficient success last winter to give great impetus to their continued use, John Hays Hammond stated in the course of a talk before the National Conference of Business Paper Editors in Washington, May 21. He admitted that the anthracite operators are worried by the prospect of competition from cheaper fuels. He said that the company mines had done much to stabilize anthracite prices. During the entire period from 1903 to 1917, he pointed out, the Reading Coal Co. advanced its rate only 25 cents per ton. He referred to this as an indication of a correct sense of public relationship as well as being good business policy for the company.

If legal and other obstacles could be removed, he said, the anthracite field could absorb many thousands of the surplus coal miners in the bituminous districts. If means can be found for reducing the costs of anthracite production and distribution, he believes its use can be extended to the point where as many as 50,000 additional miners could be employed. Mr. Hammond stated that John L. Lewis had told him that he would rather have a union with 400,000 members who had steady employment than one with 700,000 members employed only a portion of the time.

If the immigration quotas of 1890 were restored and employers permitted to recruit their own labor under that quota, well-advised opinion is to the effect that the result would be in the public interest. Under such an arrangement immigration could be drawn largely from the North of Europe. It must be admitted that the Government can not undertake a selective process in a foreign country. Private employers, however, could look up the particular type of skill in which they might be in need and in that way effect the selection of immigrants of the more desirable type.

Selecting Immigrants

For instance there has been this year a great shortage of puddlers at American steel mills. On the other hand, there has been a surplus of this type of skill in Wales. Under the present law where the employer is prohibited from making any arrangement with a prospective employee in a foreign country, it is difficult to induce the average man to come to the United States and take a chance on securing employment. Many do not have the resources to finance such a trip, yet they would be willing to come were their expenses advanced.

It is believed that any relief from the present immigration law will have to come along some such lines. There is no probability that Congress will take off the lid. Moreover, public sentiment is strongly opposed to any large increase in immigration since it is being learned that the public must take care of the unemployed in the off-peak periods.

The country's business is crossing an economic table-land. It is not going down grade. Well-advised opinion in Washington is that the country is fortunate in having relief from the rapid ascent of February and March. The great volume of buying power produced by the unprecedented amounts being distributed in wages is a real element of stability. There is full employment, no stocks and no overproduction. None of the elements of depression is present in the situation.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.	$0.034	$0.0326	$0.0236
Cold finished shafting.....	per lb.	0.042	0.0406	0.032
Brass rods.....	per lb.	0.1850	0.1913	0.1466
Solder (½ and ½)	per lb.	0.2862	0.2987	0.21
Cotton waste..	per lb.	0.1231	0.1231	0.104
Washers, cast iron (¼ in.)...	per 100 lb.	4 66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100	2.96	2.96	3.11
Lard cutting oil	per gal.	0.592	0.592	0.608
Machine oil....	per gal.	0.349	0.349	0.40
Belting, leather, medium.....	off list	42½%	42%	48½%
Machine bolts up to 1 x 30 in.	off list	44½%	44½%	62½%

It is out of the question to get back to 1913 price levels. The rate of taxation alone would preclude that. It has been the history of industry that the real factors in reducing price levels are the improvement of production methods and increasing the efficiency of distribution.

The Parlor "Red"

It is the idle rich and particularly those among them who are inclined to be immoral who are doing more to create a deep-seated impression that our present system of Government is failing than all the communists, anarchists and socialists combined, in the opinion of a high Government official.

Much of the blame for the present unrest is laid at the door of those who pull things down just for the joy of seeing them tumble, but as a matter of fact these elements in the community exert no great influence. At the bottom of the ditch are the anarchists and the communists. The sum total of the real anarchists in the country will not reach a thousand, according to this official. He would be willing to furnish the soap boxes to the 25,000 communists, which the Department of Justice estimates are in the country, and let them rave. At one time there were one million avowed socialists in the United States, but laterly there has been an admitted slump of at least one-fourth in those thus aligned. The parlor variety of socialist, who pretends not to be of that political faith, yet who assiduously plants the seed of that doctrine, is more to be feared, however, in the opinion of this official; the exhibits in each day's headlines of misconduct on the part of so-called prominent persons who have no conception of their responsibilities to the public, contribute more to discontent than all the others mentioned. It gives rise to a general suspicion that our social foundation is rotten.

New York Dealers Expect Improved Business

Many of the dealers in the New York City district reported this week that business was slightly improved and that before the month was out they expected to be able to report a healthy increase as compared with last year in spite of the bad beginning that May business experienced. There is still a call for all sorts of road machinery and even in the face of the building trades disputes, inquiries for concrete mixers are plentiful, the only difficulty being to get the product from the maker.

Inquiries generally, however, have fallen off during the past two weeks but dealers are inclined to think that this is due largely to a reaction from the heavy volume of inquiries that was received in April and March and not from any disinclination to buy on the part of the inquirers.

Heavy machinery seems to be selling better than machine tools. A few dealers who complained of poor business supplemented their remarks by a most hopeful tone as to future business.

Used machines are moving at a steady pace with no comment by dealers as to whether the future holds promise or not. Buying has proved more difficult, but the inquiries and market for all types of rebuilt and second-hand machines has not varied.

Railroads Raise Wages of Shopmen

Increases in pay amounting to about $4,000,000 a year have been granted to 55,000 shopmen of the Pennsylvania Railroad.

The raise in pay, retroactive to May 1, affects all shop employees throughout the Pennsylvania system. The hourly increase is three cents in Chicago and two cents outside the city, the higher rate of increase being due to higher living costs.

The new rate of pay will be 75 and 76 cents an hour. The Pennsylvania system reached the agreement with representatives of its company organization of shopmen, it having two years ago declined to allow the Railway Employees' Department of the American Federation of Labor to represent its employees. This act provoked a controversy with the Railroad Labor Board, whose scale for shopmen at present is 70 cents.

The Pennsylvania also is negotiating wages with its clerks and freight handlers and recently announced an increase amounting to $300,000 a year for maintenance of way employees of the northwestern region.

Several other roads have also raised the pay of workmen.

Germany's Unemployment Increasing

Manufacturers making work spread over long time—Deliveries too good to indicate prosperity —Society makes annual report showing growing membership—Export conditions

BY OUR BERLIN CORRESPONDENT

THE Society of German Machine Tool Builders has just completed the twenty-fifth year of its existence. At this occasion it has issued a jubilee booklet, to which Professor Matschoss, the well-known German historian of engineering, has contributed a brief history of German machine tool building. According to the author, it took its origin from two widely separated sources, the production of military armaments and watch-making.

The first type of a German machine tool is probably the gun boring mill, the origin of which can be traced back into the fourteenth century. One of the first lathes, made entirely of wood, is still preserved in the German museum in Munich. Another early specimen, a watch maker's lathe of elaborate artistic finish, is on view in the Kensington museum in London. Machine tool building formed for a long time a side line of general machine building. The first independent machine tool shops came into life in the middle of the last century in the Chemnitz district of Saxony, which is still the centre of German machine tool industry.

Machine Tool History

Up to the last decades of the nineteenth century, the German machine tool industry has followed the English development. Later on it came strongly under the influence of the American machine tool industry. The history of German machine tool building evidences nothing brilliant in the way of original creative ideas, but is rather marked by a steady and persevering plodding along the paths broken by other nations. Lathe building was for a long time the only line followed by independent German machine tool builders and has remained the largest ever afterward. The milling machine was added much later, followed by the other chief lines, the grinding machine closing up the file.

From the review of the society's history, which forms the second part of the booklet mentioned, it can be taken that it started in 1898 with a small membership of about 60, comprising a little more than half of the total of machine tool building works at that time.

The first president was Ernst Schiess, the original promoter of the society, owner of the Schiess machine building works in Düsseldorf, specializing in heavy-type machine tools. He was followed by Reinicker of Chemnitz, who resigned the presidency a few years ago in favor of Mr. Becker, managing director of Breuer, Schumacher & Co., Cologne, a firm of similar scope as Schiess.

The membership has grown very slowly at first, by far the majority of machine tool builders having preferred to remain outsiders. It was reserved to war times, which by endowing the society with a number of official functions enhanced the importance of its organization to bring all the stragglers within line. In 1916 the membership grew from 108 to 200 and it is now nearly 400. It comprises nearly all German works building machine tools in a wider sense, including woodworking machinery.

In the list of membership only a very few, chiefly the youngest additions to the brotherhood, are absent. The completeness of the member's roll must partly be ascribed to the inherent spirit of discipline, greatly strengthened of late by the rigid organization of the whole industry, and partly to the fact that the society is officially endowed with the control of machine tool exports, which makes the membership almost compulsory to manufacturers.

Network of Organization

The thorough organization of the German industry completed during the last year is one reason why the society of German machine tool builders has lost its character of an independent association. It has become a unit in the structure of the whole German industry, subdivided in big groups, to which the various units are subordinated, all linked together under the leadership of the National Society of German Industry. In this way the society of German machine tool builders has become one of the twelve sections of the association of German machine building works and has in its turn several subalterns, like the society of German builders of wood-working machinery, the society of twist drill manufacturers and of manufacturers of measuring tools.

American Competition

From the history of the society it appears, that prior to the war it has devoted a good part of its activity towards warding off American imports of machine tools. The strong efforts made to obtain protection by tariff have, however, never been successful. Of recent achievements of the society may be mentioned the formation of the research society for scientific management, to which the machine tool laboratory at the technical high school in Charlottenburg, conducted by Professor Schlesinger, and the psycho-technic department of this high school are annexed. The society is now subdivided into 25 groups, each heading special lines of machine tool building. Besides it has a number of committees, of which may be mentioned those for foreign trade, price policy and cost calculation.

A classification of the membership of the society shows the following figures, which are of interest, in so far as they practically comprise the whole of German machine tool building: Machine tools proper 285, sheet machinery 50, wood-working 20, miscellaneous 35. Eighty of these firms are now incorporated as joint stock companies.

The jubilee of the society falls into a time, which is the reverse of auspicious. Several months ago the market gave signs that the opportunities offered the industry by the course that economic developments have taken would soon be exhausted. The steady decline of the market, contingent with the unparalleled downslide of the mark rate seemed indeed to herald the end of the so-called inflation boom. The developments following the Ruhr occupation have greatly precipitated the course of events. The ratio of unemployment in the industry, which in September was only 0.2 per cent, has in the subsequent months risen to 0.8 per cent in December, 1.3 per cent in January, 2.3 per cent in February, and has in April arrived at a figure which was never reached in post-war times. If it has so far not taken stronger dimensions, it is only for the reason of the orders still in hand and for the fact that manufacturers are compelled by law to "stretch" work by reducing working time before proceeding to dismissal.

For the latter reason the German rate of unemployment is no proper evidence of business conditions. According to the official labor gazette, the number of machine building firms working short time has up to April steadily increased.

Coal and Iron Reserve

Of the adverse circumstances surrounding the industry, the supply of fuel and basic material is still, in defiance of all expectations, the most favorable item. Imports and reserves in the country, in conjunction with the decline of business, have helped to provide for all requirements in a manner which, according to reports from all parts of the country, constitutes even an improvement compared with the closing months of last year. The depression of the domestic market explains itself.

If, as it is said, business is nothing but optimism, there would hardly be any business at all. It is surprising to see how it has withstood so long the onslaught of growing despair. The export business must for the time being be considered wrecked almost completely. It was not tempting to German manufacturers during the brief period of mark stabilization and foreign buyers have in their turn withdrawn before the uncertainty of delivery.

As far as the occupied parts are concerned, such fears are indeed well-founded, as the whole output of the last three months is completely tied up in the works. Arrangements are now on the way, which will allow machines, contracted for before Feb. 20, to be shipped at the risk and expense of the foreign buyer.

A regular export business is, however, out of the question for the machine tool builders in the occupied parts. Moreover, labor efficiency in these parts has taken such turn to the worse, evidently in consequence of the general disorganization, that manufacturers in occupied Germany are faced with a higher cost of production than those in the German interior. If the

latter have hoped that they would profit by the checkmate of their competitors in the occupied zones as regards export, this hope has so far been severely disappointing, although there is no question of their being able to deliver and delivery times quoted are indeed much shorter than they were during the last years.

The export business can hardly be expected to recover as long as the extraordinary business conditions into which Germany has been plunged by the Ruhr occupation will last. Definite figures of export are so far only available for the first two months of the year, which mostly comprise deliveries on orders filled during the last months of 1922. Nevertheless, they show already a certain decline. The total of machine tool export in January was 4,025 metric tons and in February 3,447 tons as against a monthly average in 1922 of 4,977 tons. The following figures show the export of machine tools during the first months of the year compared with the corresponding period of 1922, with the share of the main countries of destination:

	January-February 1923	January-February 1922
	Metric Tons	Metric Tons
Belgium	346	1,769
France	1,458	1,175
Great Britain	479	568
Holland	478	968
Austria	485	632
Czecho-Slovakia	200	556
Switzerland	340	396
Spain	192	284
European countries, total	6,098	9,838
China	137	167
Dutch Indies	140	148
Asia, total	458	514
U. S. A.	269	204
Argentine	223	276
Brazil	184	135
America, total	775	691

As can be seen, the export to European countries has dropped to about 60 per cent of last year's. With the exception of France, all countries of destination have contributed to this drop. Only the export to America shows a slight increase. What has been said about machine tools, applies in even stronger degree to the whole of machine building as it exists today in Germany.

Book Reviews

Business Cycles and Unemployment. Report and recommendations of a Committee of the President's Conference on Unemployment, including an investigation made under the auspices of the National Bureau of Economic Research. With a foreword by Herbert Hoover. Four hundred pages, 6x9 in., cloth boards. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $4.

A book foreshadowing the new era of economics in business. Its preparation by a committee of the President's Conference on Unemployment, and the personnel engaged in the work, make it a volume that must be considered an important business adjunct. Unemployment, resulting from business depression, itself increases depression. Each is a part of the other and both are a part of the business cycle. When employment is universal, or almost so, prosperity is greatest. The value of a book that gives even a clue to remedying the evils of unemployment is self evident.

As a result of the business slump of 1921 there were between four and five millions unemployed. To consider their relief the Conference on Unemployment met in Washington in September, 1921. From that meeting resulted the proposal that an investigation should be made of the problem of unemployment and of methods of reducing it, and that consideration should be given to suggestions for controlling the extremes of the business cycle.

The Secretary of Commerce appointed as a committee: Owen D. Young, chairman of the board, the General Electric Co., Chairman; Joseph H. Defrees, former president, U. S. Chamber of Commerce; Mary Van Kleeck, the Russell Sage Foundation; Matthew Woll, vice-president, the American Federation of Labor; Clarence M. Woolley, president, the American Radiator Co.; Edward Eyre Hunt, secretary of the President's Conference on Unemployment, secretary.

The Carnegie Foundation contributed an appropriation toward its cost and the following contributed services: National Bureau of Economic Research, the Russell Sage Foundation, the Federated American Engineering Societies, the U. S. Chamber of Commerce, the American Federation of Labor, the American Statistical Association, the Bureau of Railway Economics, the Department of Commerce, and others.

"The Relation of Business Cycles to Unemployment" is the title of the first part of the book, which gives a general description of business cycles. The title of the second part, giving facts concerning the extent of unemployment, is "Cyclical Fluctuations in Employment." That of the third, which recounts the various proposals and attempts that have been made to meet the situation, is "Proposed Remedies for Cyclical Unemployment."

Preceding the three parts referred to is a report of the Committee, pointing out the need for facts in business and giving ten recommendations. The report emphasizes the necessity for industries to furnish data for the assembling of statistics by which they may be guided in business activities.

That part of the book compiled by the National Bureau of Economic Research was intended to furnish the committee with such explanations concerning the nature of business cycles and the fluctuations in employment as are necessary for understanding the problem; the character and bearing of the leading devices which have been tried or proposed for mitigating unemployment through control over the fluctuations of business activity; and the conditions which must be considered in judging the probable effectiveness of these devices. The Committee is in no way responsible as a committee for the finding in the Bureau's report and the Bureau does not make itself responsible for the statements and recommendations of the Committee.

Of especial interest to the machinery industries are the illustrations by Wesley C. Mitchell pointing out that the demand for industrial equipment changes much more than the demand for the product and the discussion by N. I. Stone on the effects of the elasticity of demand.

Pulling Together. By John T. Broderick, with introduction by Charles P. Steinmetz. Including a sequel, "Untouched Wealth." Sixth printing. One hundred sixty-seven pages, 5x7 in., cloth boards. Published by Robson & Adee, Schenectady, New York. Price $2.

A book dealing with human relations in industry, advocating in particular employee representation in management. The story is represented as a dialogue between the president of a corporation employing 30,000 people and a traveling machine tool salesman. On account of the style adopted and the plain, direct way of telling, the book will make excellent reading for both plant executives and for employee. It will probably not leave the plant owner or manager entirely sold on the matter of employee representation, but will go far to convince him that there is much to be said for it, and that it might under the right conditions and if properly applied solve many of his labor difficulties.

Labor leaders, minor executives and those they direct, if open-minded, should profit by a reading of "Pulling Together," if only to be told again that "the interests of those engaged in industry, whatever the nature of the functions they exercise or of the service they perform, are—or should be—identical, not dissimilar, and, therefore, that their relations should be harmonious, not antagonistic." Also "that the industrial system is dependent for its existence upon coordinated effort and the human beings who supply that effort have motives and purposes that are common and cannot be otherwise."

The sequel points out the necessity for a broader understanding of human relations, in order to make possible the production of that quantity of wealth which will be sufficient to prevent conflict between employer and employee.

Report of Westinghouse Shows Increases

The net income of the Westinghouse Electric & Manufacturing Co. for the year ending March 31, 1923, was $12,263,485 as shown by the annual report. The dividend requirements were $6,033,428, so that over twice this amount was earned and more than six million dollars added to the surplus. Gross sales for the year were $125,000,000, which represents an increase of $25,000,000 over the sales of last year. The cash position of the company is a strong one, the current assets totalling over $106,000,000, and the current liabilities less than $17,000,000, it is announced.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Woodworking machinery, including foursided planers and molders, band resaws, single and double surfacers, triple-drum sanders and dovetailing machines. Sydney, Australia. Agency. Reference No. 6474.

Fruit packing house equipment, fruit drying and canning machinery and full equipment for jam and canning factories. Christchurch, New Zealand. Purchase. Reference No. 6475.

Triple-drum sanders with traveling bed, size forty-eight inches, cabinet-making machinery. East London, South Africt. Purchase. Reference No. 6477.

Machinery of all kinds for fruit packing, canning and drying. Cape Town, South Africa. Agency. Reference No. 6477.

Motorcycle accessories, motor car accessories, repair shop machinery. Funchal, Madeira. Agency and purchase. Reference No. 6479.

Automobile accessories and specialties of a non-technical nature. Rio de Janeiro, Brazil. Agency. Reference No. 6483.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

Taylor Society. Meeting at the Hotel Onondaga, Syracuse, N. Y. June 7, 8 and 9.

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

American Society for Testing Materials. Annual meeting at Atlantic City, June 25 to 29, Chalfonte-Haddon Hall. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

Section V Mechanical of the American Railway Association. Annual meeting at Orchestra Hall, Chicago, June 20, 21 and 22. V. R. Hawthorne, 431 South Dearborn St., Chicago, secretary.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit during the month of September, New Haven, Conn.

New and Enlarged Shops

Machine Tools Wanted

Ariz., Tucson—C. H. Edwards, Pres.—machine shop equipment, including drill, press, lathe, etc.

Ill., Chicago — Chicago & Northwestern Ry., 226 West Jackson Blvd., F. J. Berck, Genl. Purch. Agt.—one motor driven 18 in. x 12 ft. engine lathe; presses, lathes, belting, shafting and iron working machinery for proposed machine shop at Madison, Wis.; coal handling machinery for proposed $45,000 coaling station at Milwaukee.

Ill., De Kalb—Sawyer & Sons (automobile repairs)—air compressor, gasoline storage tank and pump, also drill press, about 18 in.

Ind., Hammond — Wanner Malleable Castings Co.—drop hammer, rope or crank type, 500 or 1,000 lb. capacity.

Kan., Benton—W. A. Mason Garage—power lathe and power drill press (used preferred).

Kan., Benton—G. Medworth—power lathe for machine shop.

Kan., Wellington—Brady Regrinding Co., Main St., J. J. Brady, Purch. Agt.—16 in. power lathe for metal work.

Kan., Wellington—E. Cummings, Main St. (garage)—30 in. power metal lathe (used).

Kan., Wellington—F. Stark, 120 East Lincol St. (garage)—power lathe, belting, hangers, pulleys, shafting, bearings, emery stand, cylinder grinder and power drill press.

Kan., Wellington—J. W. Washburn, 122 East Lincol St.—adjustable tinner's brake.

Mass., Boston—H. Swanson, c/o J. H. MacNaughton, Archt., 177 State St.—machinery for proposed $15,000 machine shop and garage at Newton (Boston, P. O.).

Mich., Detroit—A. N. Haskell, 1045 Hibbard Ave.—two or more drill presses, sensitive ball bearing type.

Mo., St. Louis—B. Wolff & Sons, 2219 South 4th St. (pipe dealers)—pipe cutting and setting up machines up to 4 in.

N. Y., Buffalo—Bd. Educ., 1400 Telephone Bldg., D. J. Sweeney, Deputy Supt. Business and Accounts—receiving bids until June 4 for four motor head speed lathes, two pattern makers lathes, six engine lathes, one metal spinning lathe, one polishing lathe, two Fay & Egan speed lathes, twelve work benches, one Universal saw bench, belting, one sander, one tool, one floor and one oilstone grinder, jointer and buzz planer, one power squaring shear, one power circle shear, one throatless shear and stand, one hand box and pan brake, one steel brake, one drill press, one air compressor, and one bandsaw.

N. Y., Jamestown—Los Angeles Tool Co., 209 Hopkins Ave.—tool works machinery and equipment.

O., Cleveland—Amer. Steel & Wire Co., Western Reserve Bldg.—one steel bending brake.

O., Columbus—Amer. Motor Co., 796 East 11th Ave. (manufacturer of automobile parts and water motors), L. J. Jacobs, Secy.—metal working machinery to increase capacity of plant.

O., Columbus—E. J. Ogle, 1088 North High St. (tin and metal roofing, etc.)—metal working machinery to enlarge shop.

Pa., Pittsburgh—United Eng. & Fdry. Co., Farmers Bank Bldg., A. Sanborn, Purch. Agt.—one 18 in., one 24 in., one 36 in. and two 30 in. lathes, all motor driven.

R. I., Providence—E. A. Eddy Mchy Co., 211 Eddy St.—two No. 16 Blanchard heavy duty vertical surface grinders (used).

Tex., Dallas—Oakcliff Paper Mills, J. G. Fleming & Sons, Sta. A. (owners), E. F. Fleming, Purch. Agt.—power lathe, 106 in. long, for heavy duty to hold 3,000 to 4,000 lb., 10 ft. bed to clear 7 ft. 4 in.

Va., Richmond—Fords Service Station, 10th and Broad Sts.—burning in stand, motor stand and lathe.

Va., Seven Pines (Richmond, P. O.)—Spruces Auto Repair Shop—lathe and drill press.

Wis., Hilbert—C. F. Lawler—automobile repair machinery, press, small tools, gasoline tank and pump for proposed garage and repair shop.

Wis., Mayville—Feilbach Mfg. Co., W. O. Feilbach, Mgr.—special machinery, lathes, press, small tools, etc., for proposed factory for the manufacture of automobile accessories.

Wis., Menasha—United States Tractor & Mchy. Co., G. D. Harris, Genl. Mgr.—special machinery, power machinery, lathes, presses, etc., for the manufacture of automobiles.

Wis., Milwaukee—Boynton Auto Livery Co., 449 Milwaukee St.—chain hoist, drill press and lathe, both for heavy duty garage service.

Ont., Toronto—Bd. Educ., 155 College St., W. W. Pearse, Administrator—equipment for Riverdale Technical School, including pony planer and grinder; shop benches; metal working, woodworking and foundry tools; wood trimmer; gas, oil and soft metal furnaces; plain milling machine; cutter grinder and motor repair tools.

Que., Acton Vale—G. Charland—automobile repair equipment.

Que., Drummondville — MacDonald Wire Goods Co., Ltd. (stamped and wire hardware specialties), J. S. MacDonald, Secy.—one electric butt welder, one electric spot welder, one 14 in. shaper, one 12 in. x 5 ft. lathe and three power presses.

Que., Farnham—J. A. Viens, St. Joseph St.—automobile repair equipment.

Que., Thetford Mines—Beattie & Larochelle, Notre Dame St., E. Larochelle, Purch. Agt.—equipment for garage and automobile repair shop.

Machinery Wanted

Calif., San Francisco—Southern Pacific R. R., Southern Pacific Bldg.—rock crushing plant for use at Palisade, Nev.

Colo., Saguache—M. E. Lewis—newspaper press, paper cutter and complete equipment.

Conn., South Norwalk—Hatch & Bailey Co., Marshall St.—machinery for proposed $45,000 lumber and millwork plant.

Fla., Orlando—I. K. Berman and J. N. Wigfall—two flatwork mangles, one floating roll, sixteen steam presses, washers, hot air drying tumblers and dyeing equipment, all motor driven, for proposed $100,000 laundry on Concord Ave.

Ind., Evansville—F. Miller Bakery & Ice Cream Co., 315 U 6th St.—refrigerating machinery for ice cream factory and cold storage plant.

Ind., Huntingburg—Patoca Furniture Mfg. Co.—woodworking machinery and equipment, including sanders, stickers, planers, molders and conveying machinery, for new factory.

Ind., Indianapolis—F. E. Weimer, 503 North Pennsylvania Ave. (job printer)—No. 2 or 3 linotype.

Ind., Jeffersonville — Jeffersonville Canning Co., Court and Walnut Sts.—equipment for proposed $40,000 plant.

Ind., South Bend—Peterson Storage Battery Co., 323 South Lafayette St.—machinery and equipment for 1 story addition to storage battery factory.

Ia., Le Mars — Bd. Educ. — vocational equipment for $100,000 school.

Kan., Eldorado—J. W. Mathis, 302 East Central St.—complete welding outfit.

Kan., Ellsworth — Patterson Bros. (garage)—acetylene generator and welding outfit.

Kan., Pittsburgh — Pittsburgh Boiler & Machine Co.—two 3 to 5 ton electric hoists, 220 volt, 60 cycle, 3 phase for electric crane use (used).

Kan., Towanda—C. E. Gregor, c/o Conley Lumber Co. (cabinet maker)—power rip saw.

Kan., Wellington—Gallemore Printing Co., R. C. Gallemore, Purch. Agt.—power paper cutter and job press (used).

Kan., Wellington—Monitor Press, J. G. Campbell, Purch. Agt.—power paper cutter and power job press with Miller feeder (used).

Kan., Wellington — Wellington Planing Mill, 112 West 8th St., G. C. Hartzell, Purch. Agt.—power belt sander.

Ky., Maysville—Glascock Dairy & Ice Cream Co.—refrigerating equipment. Cost will exceed $1,000.

Ky., Paducah—Paducah Electric Co.—coal handling machinery for proposed power plant.

Mass., Boston—Graham Press, 16 La Grange St.—cylinder press, Kelly preferred (used).

Mass., Boston—Hunt-Spiller Mfg. Corp., 385 Dorchester Ave.—foundry machinery and equipment.

Mass., Gardner—Chairman of School Com. —woodworking machinery for new high school.

Mass., Marlboro—Marlboro Wire Goods Co.—machinery for new factory for the manufacture of wire goods, etc.

Mass., New Bedford—Z. B. Davis Corp., 660 Acushnet Ave.—additional woodworking machinery, including bandsaws, planers, matcher, jointers, tables, benches, etc.

Mass., New Bedford—A. Jutras, 727 Belleville Ave.—tools for light woodworking, including planer, matcher and bandsaw (used).

Mass., Waltham—J. L. Thomson Mfg. Co., Roberts Sta.—machinery for proposed $90,000 factory for the manufacture of buckles and rivets.

Mass, Wellesley (Boston, P. O.)—W. H. Partridge, 20 Brook St. (gravel pit, also manufacturer of concrete blocks)—medium size stone crusher, conveyor loader, concrete block machine, platform scales, scoop and plow for Fordson tractor (used).

Mich., Petosky — Northwestern Pulp & Paper Co.—paper and pulp mill machinery, to replace that which was destroyed by $100,000 fire.

Minn., Amboy—S. R. Brush (dairy products)—power churn, separator, belting and shafting.

Minn., Fergus Falls—Star Laundry, E. J. Windmiller, proprietor — power machinery for proposed 1 story, 45 x 150 ft. steam laundry.

Minn., Minneapolis—Troy Cleaners, Inc., Chicago Ave. and 10th St.—one power overdriven extractor, 40 to 48 in. diameter.

Mo., Joplin—Amer. Laundry Co., 1729-31 Main St., A. B. Crandall, Purch. Agt.—belting, hangers, pulleys, bearings, power washing machine and power ironing machine.

Neb., Hebron—Champion (newspaper)—standard intertype machine.

N. Y., Batavia—Genesee Stone Products Co., A. B. Caldwell, Pres.—stone quarry machinery and equipment, including large stone crusher, conveying machinery, etc.

N. Y., Binghamton — Truitt Bros., 336 Water St. (leather findings)—machinery and leather working equipment for $25,000 factory.

N. Y., Endicott—Beavan & Chapman, Main St.—machinery and equipment for factory for the manufacture of patented Ford timer.

N. Y., Endicott—Card & Fetter—planing mill machinery and equipment, including saws, conveying machinery, planers, etc.

N. Y., Green Island (Troy, P. O.)—Manning Abrasive Co., H. Eldred, Purch. Agt.—transmission, grinding, screening, glueing machinery, etc., for the manufacture of sand paper for proposed $175,000 factory.

N. Y., Jamestown—E. F. Swanson, 217 West 3rd St.—bake oven and bake shop equipment.

N. Y., New York—M. Benjamin, 236 Canal St.—plating dynamos.

N. Y., New York—Federal Mining & Smelting Co., 120 Bway.—concentrator for Smithers, B. C.

N. Y., New York—E. Maag, Inc., 32 West 23rd St. (upholsterers' trimmings)—4 x 4-24 harness worsted loom (used).

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Steel — Structural market stable, but with easier tone. Minimum on bars, $2.40 and on shapes, $2.50 per 100 lb. on all current mill business; maximum placed at $2.60. Plate inquiries fair, especially on ship and tank plates, with buying trifle slower. Mill shipments heavy. Minimum on steel plates, $2.50 per 100 lb., Pittsburgh, for prompt deliveries.

Advances—Black steel sheets up 10c. per 100 lb. at Pittsburgh mill. Wrought steel pipe discounts lower in New York warehouses. Recent downward trend in all non-ferrous metals checked by upward turn in lead and tin. Improvement in domestic lead market due to weaker foreign competition. Upward tendency in cotton waste due to curtailment in textile mill output. Linseed oil firm but unchanged. Lubricants and lard oil markets improved, with inquiries and buying heavier.

Declines—Copper tending downward after recent slight advance; zinc also weaker. Antimony reduced ½c. per lb. in week. Dealers' purchasing prices of old metals (non-ferrous) down ½c. to 1c. per lb. in Cleveland, during week.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	32.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.94
BIRMINGHAM	
No. 2 Foundry	26.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	35.17
Basic	31.50
Grey Forge	30.00
CHICAGO	
No. 2 Foundry local	33.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.00
Basic	31.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00
Cleveland	5.60@6.25
Cincinnati	6.75
New York	5.50@5.75
Chicago	4.00@5.00

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00@3.35	4.59	3.90	4.15
No. 12	3.10@3.45	4.64	3.95	4.20
No. 14	3.20@3.55	4.69	4.00	4.25
No. 16	3.40@3.75	4.79	4.10	4.35
Black				
Nos. 17 and 21.	3.70@4.10	4.95	4.55	4.85
Nos. 22 and 24.	3.75@4.15	5.00	4.60	4.85
Nos. 25 and 26.	3.80@4.20	5.05	4.65	4.90
No. 28	3.85@4.25	5.15	4.75	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00@4.50	5.15	4.80	5.10
Nos. 12 and 14.	4.10@4.60	5.25	4.90	5.20
Nos. 17 and 21.	4.40@4.90	5.55	5.20	....
Nos. 22 and 24.	4.55@5.05	5.70	5.35	5.65
No. 26	4.70@5.20	5.85	5.60	5.80
No. 28	5.00@5.50	6.15	5.90	6.10

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	62	50½	⅜ to 1¼	30	13
		LAP WELD			
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
		BUTT WELD, FXTRA STRONG, PLAIN ENDS			
1 to 1½	60	49½	¾ to 1½	30	14
2 to 3	61	50½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50@8.00	8.00	7.35
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.30
Cold finished flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.32½
Soft steel bar shapes (base)	3.54	3.36	3.32½
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.71	3.40
Bar iron (3.25 at mill)	3.54	3.36	3.32½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%
Electric welding wire:			
5/16	8.50		14.00
⅛	7.35		12.25
5/32 to ¼	7.10		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			16.12½
Tin, 5-ton lots, New York			43.50
Lead (up to carlots), St. Louis	7.15;	New York.	7.72½
Zinc (up to carlots), St. Louis	6.55;	New York.	7.10

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	30.00	28.50
Antimony (Chinese), ton spot	8.12½	11.00	8.75
Copper sheets, base	26.50	24.25	23.00
Copper wire (l.c.l.)	18.12½	22.00	16.25
Copper bars (l.c.l.)	22.50	25.25	19.50
Copper tubing (l.c.l.)	27.00	30.25	23.00
Brass sheets (l.c.l.)	20.50	25.25	18.75
Brass tubing (l.c.l.)	25.50	30.75	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (l. c. l.)	18.75	21.00	15.75
Brass wire (l. c. l.)	21.00	22.00	.....
Zinc sheets (casks)	11.00	10.40	.....
Solder (½ and ¼), (caselots)	31.50@33.50	29.50@31.50	20.00
Babbitt metal (83% tin)	60.00	55.00	41.00
Babbitt metal (35% tin)	35.00	17.50	18.00
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	35 00
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	13.00	14.00
Copper, heavy, and wire	13.25@13.75	12.00	13 00
Copper, light, and bottoms	11.25@11.75	10.50	12.00
Lead, heavy	5.00@ 5.50	4.00	6.25
Lead, tea	4.50@ 4.75	4.00	5.25
Brass, heavy, yellow	7.50@ 7.75	....	8.50
Brass, heavy, red	11.00@11.50	10.50	10.50
Brass, light	6.00@ 6.50	5.50	7.00
No. 1 yellow brass turnings	7.50@ 7.75	7.00	7.75
Zinc	3.75@ 4.25	3.50	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	23.50	19.50	18.50
IX,	20x28, 112 sheets	26.00	22.25	20.90
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
IX,	20x28, 112 sheets	23.50	19.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	13.00	12.60	14.50
IC,	112 sheets	13.30	13.00	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	8.00	6.65	7.25
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13½x13½, per lb.	11.25	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	3.50	2.65
Roll sulphur, per 100 lb.	2.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.16	1.33	1.37
White lead, dry or in oil	100 lb. kegs.	New York, 14.50	
Red lead, dry	100 lb. kegs.	New York, 14 50	
Red lead, in oil	100 lb. kegs.	New York, 16.00	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.50@6.00	
Coke, prompt foundry, Connellsville	per net ton	6.00@7.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1½x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	60%	.....	.....
Semi-finished nuts, ⅜ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, 5/16 in. dia. and smaller	40%	50-10%	50%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¼-in., ⅜-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.60	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	.50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., New York—Ort Steel Co., 313 East 22nd St.—small spot welder.

N. Y., Ripley — Bd. Educ. — vocational equipment for proposed $150,000 school.

N. Y., Springville — Springville Canning Co.—canning machinery and equipment, to replace that which was destroyed by fire. Loss $25,000.

N. Y., Waterford—Ford Mfg. Co.—sewing machines, etc., for the manufacture of nainsook underwear.

N. C., Concord—Concord Knitting Co.—knitting machinery and other equipment for mill.

N. C., Winston-Salem—Chatham Mfg. Co. (manufacturer of bed blankets)—two warp compressing machines for woolen warps (used).

N. D., Minnewaukan—E. R. Cline (job printer)—linotype.

O., Columbus—Dept. of Welfare, 9th and Oak Sts., J. E. Clark, Purch. Agt.—machinery for brick plant at Junction City.

O., Columbus—Nelson Lumber & Mfg. Co., 372 Dublin Ave., H. B. Nelson, Mgr.—two woodworking machines.

O., Toledo—J. Schrailberg, 2135 Scottwood Ave. (cleaner)—power tumbler and extractor.

O., Zanesville—C. H. Hubbell (manufacturer of tires and tubes)—tire making machinery.

Okla., Barnsdale (Avant, P. O.)—Barnsdale Refining Co.—complete machinery and equipment for 8 unit addition to oil refinery.

Okla., Cushing — Bd. Educ. — vocational equipment, including lathe, drill, saws, etc., for $100,000 school.

Okla., Tulsa—F. W. Freeborn Eng. Corp., Mayo Bldg., H. L. DeBar, Purch Agt.—large air compressor and outfit.

Pa., Erie—Atlantic Refining Co.—equipment, including air compressor, for gasoline and service station on Buffalo Rd.

Pa., Greensburg—Fisher Traffic Co., T. Fisher, Mgr.—electrically operated ice manufacturing machinery and equipment, including ammonia tanks, compressors, etc., for proposed plant at New Castle.

Pa., Indiana—Bd. Educ., W. S. Daugherty, Pres.—equipment for vocational department of proposed $350,000 high school.

Pa., Johnstown—Moxham Lumber Co., Park and Griffith Sts., S. E. Deeter, Mgr.—planer, shaper, sanding machine and rip saw for planing mill.

Pa., Pittsburgh—Reliance Steel Castings Co., 28th St. (foundry)—5 ton, 28 ft. 6 in. span crane.

Pa., Warren—Nypenn Furniture Co., 308 Onandago St.—coal conveying machinery.

S. C., Newberry—L. A. Wilson—complete brick manufacturing machinery and equipment.

S. C., St. Matthews—Bd. Educ.—complete vocational equipment, including saw, press, small tools, etc.

Tex., Eagle Lake—Bd. Educ.—complete vocational equipment for $150,000 school.

Wis., Ashland—M. C. Connors, foot of 23rd St.—one hoisting crane.

Wis., Beaver Dam—Bd. of Industrial Educ.—one 20 to 30 in. bandsaw, joiner, large surfacer and oil stone grinder.

Wis., Berlin—Schaefer Mfg. Co., F. D. Chapman, Genl. Mgr.—special machinery for the manufacture of equipment for canning factories, also belting and shafting.

Wis., La Crosse—Bd. of Industrial Educ., J. B. Funke, Pres.—wood and iron working machinery, lathes, presses and small tools for proposed $150,000 vocational school.

Wis., La Crosse—Weisse Mfg. Co., Caledonia and Gilett Sts.—millworking machinery, planer and lathe for proposed $75,000 factory.

Wis., Madison—C. Kessenick, 1840 Chadbourne Ave.—battery charging equipment, gasoline pumps, small tools, etc., for battery service station.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (woodworking)—4 or 5½ in. sticker and one double or triple drum sander.

Wis., Milwaukee—H. J. Marks, 2442 Lloyd St.—woodworking machinery, including rip saw, cross cut saw and planer.

Wis., Milwaukee—H. P. Mellus, 2618 Grand Ave. (moving and storage)—one medium size circle saw to cut material for crating.

Wis., Milwaukee—Rohn Automobile Renewal Co., 711 Chestnut St.—woodworking machinery for proposed $50,000 factory.

Wis., New London—The city, C. J. Thompson, Clk.—dumps and conveyors for unloading sand and gravel from railroad cars.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., C. S. Anderson, Mgr.—equipment for core ovens, conveyors, etc.

Wis., Stoughton—Stoughton Wagon Co., C. H. Cox, Genl. Mgr.—special machinery, woodworking equipment, small tools, etc., for plant for the manufacture of truck bodies at Janesville.

Man., Selkirk—Canadian Insulation Co., Ltd.—machinery for the manufacture of flax fibre for furniture upholstery.

Ont., Haileybury—Kirkland Gold Mines, Ltd., A. Laprerle, Purch. Agt.—development and other equipment.

Ont., Kirkland Lake—Bidgood Gold Mines, Ltd., D. Hughes, Engr.—drilling equipment.

Ont., Lindsay—J. Horn Knitting Co., Ltd.—equipment for 3 story addition to factory for the manufacture of hosiery.

Ont., Stayner — W. H. Slight — complete equipment for planing mill, to replace that which was destroyed by fire.

Ont., Toronto—R. N. Boxer Co., Ltd., Fay Bldg.—electrically operated wall paper manufacturing equipment for proposed $250,000 factory at New Toronto.

Ont., Toronto — Burnt River Quarries, Ltd., L. Wookey, 608 Jarvis St., Purch. Agt.—machinery for crushing and quarrying.

Que., Danville—L. A. Dion, Depot St. (carriage maker)—woodworking machinery.

Que., East Angus — Brompton Pulp & Paper Co., J. A. Bothwell, Genl. Mgr.—additional machinery to increase capacity of plant.

Que., Granby—Barre & Charron, Court St., A. Barre, Purch. Agt.—machinery for the manufacture of doors, paneling, etc.

Que., Grand Mere—S. Venne, 183 St. Catherine St.—additional equipment for sawmill.

Que., Knowlton — D. H. Green, Lansdowne Rd.—additional sawmill equipment.

Que., Montreal—Creameries Mont Royal Limitee, A. Cote, 1169 Delormier Ave., Purch. Agt.—machinery and equipment for production, manufacture and transforming cream.

Que., Montreal—Harbor Comrs. of Montreal, M. P. Fennell, Jr., Genl. Mgr.—elevating machinery for extension of grain elevator B at Windmill Point.

Que., Montreal — A. Racine, 1990 St. Dominique St.—machinery and equipment for the manufacture of automobile bodies and carriages.

Que., Montreal—Traversy, Ltd., 136 Papineau Ave. (manufacturer of sash and doors), A. Traversy, Purch. Agt.—woodworking machinery.

Que., Plessisville—A. Rousseau (manufacturer of sash and doors)—woodworking machinery.

Que., Scottstown—Reid Mfg. Co. (manufacturer of chairs, etc.), P. Reid, Purch. Agt.—woodworking machinery.

Que., Westmount—Wigwam Mining Co., Ltd., c/o R. Starke, 433 Elm St., Pres.—crushing machinery; other equipment later.

Metal Working Shops

Calif., Eureka—C. Green, 7th and D Sts., awarded the contract for the construction of a 1 story garage with service and parts departments, etc., on 4th and H Sts. Estimated cost $40,000.

Calif., Glendale (Los Angeles P. O.)—H. C. Powell, c/o Rogers Una-Drive Motor Truck Co., 105 East Colorado St., plans to build the first unit of motor truck plant. Cost will exceed $50,000. Engineer or architect not selected.

Calif., Long Beach — S. Kennelly, 427 American Ave., awarded the contract for the construction of a 1 story automobile service building on 6th St. and American Ave. Estimated cost $60,000.

Calif., Oakland—The L. R. Lurie Co., 315 Montgomery St., San Francisco, awarded the contract for the construction of a 1 story garage on 32nd and Adeline Sts., here. Estimated cost $42,000. Noted Apr. 26.

Conn., Hartford—H. Bland, 521 Park St. awarded the contract for the construction of a 1 story, 50 x 120 ft. garage. Estimated cost $40,000. Noted May 10.

Conn., New Haven—Dutee Wilcox Flint, Inc., 51 Bway., awarded the contract for the construction of a 1 story 50 x 170 ft. addition to its Ford assembly plant on James & River Sts. Estimated cost $40,000.

Conn., Putnam—J. E. and E. Stoumbelis are having plans prepared for the construction of a 2 story, 60 x 90 ft. garage on Bundy St. Estimated cost $40,000. L. E. Conway, Goldsmith Blk., New London, Archt.

Conn., Stamford—J. and S. Gruber are having plans prepared for the construction of a 2 story, 80 x 90 ft. garage on Buckley Ave. Estimated cost $55,000. Emmens & Abbott, Washington Bldg., Stamford, Archts.

Ill., Chicago—The Chicago, Rock Island & Pacific Ry., La Salle St. Sta., plans improvements to shops, etc., along its system. L. C. Fritch, Vice-Pres., in charge of construction of maintenance.

Ill., Chicago—The Wisconsin Steel Co., 106th and Torrence Sts., awarded the contract for the construction of a 1 story, 44 x 125 ft. steel factory. Estimated cost $125,000.

Ill., Granite City — The Commonwealth Steel Co. has had plans prepared for the construction of a 1 and 2 story steel plant, consisting of a hearth furnace, 75 ton daily capacity; addition to power plant; coke oven building; metal pattern shop; additions to foundry and core room. Estimated cost $1,000,000. Private plans.

Mass., Boston—The Chamberlain Garage, Inc., c/o L. Joselyn, Archt., 339 Newbury St., is having plans prepared for the construction of a 4 story, 88 x 185 ft. garage on Stoneholm St. Estimated cost $300,000.

Mass., Boston—The Hunt-Spiller Mfg. Corp., 385 Dorchester Ave., manufacturer of gun metal and castings, will soon receive bids for the construction of a 1 story, 135 x 240 ft. foundry at 383 Dorchester Ave. Estimated cost $500,000, including machinery. Andrews, Rantoul & Jones, 50 Congress St., Boston, Archts.

Mass., Everett (Boston, P. O.)—The Boston Elevated Ry. Co., Massachusetts Ave., Boston, awarded the contract for the construction of 2 story, 118 x 175 ft. repair shops, here. Estimated cost $275,000. Noted May 3.

Mass., Fall River—M. and G. Colovas and G. Vlhes awarded the contract for the construction of a 2 story, 100 x 175 ft. garage on 4th and 5th Sts. Estimated cost $125,000.

Mass., Newton (Boston, P. O.)—H. Swanson, c/o J. H. MacNaughton, Archt., 177 State St., Boston, awarded the contract for the construction of a 1 story, 40 x 50 ft. machine shop and garage, here. Estimated cost $15,000.

Mass., Waltham—The J. L. Thomson Mfg. Co., Roberts Sts., manufacturer of buckles and rivets, awarded the contract for the construction of a 3 story, 50 x 220 ft., factory. Estimated cost $90,000.

Minn., Duluth—The Oliver Iron Mining Co. plans to build an ore crushing plant, including heavy railroad spurs and yard changes program, for Hibbing Dist. Mines. Estimated cost $2,000,000.

Mo., Kansas City—The Sheet Metal Products Co., 1819 Central St., awarded the contract for the construction of a 1 story, 125 x 305 ft. factory. Estimated cost $60,000.

N. Y., New York—The Klein Corp, c/o Gronenberg & Leuchtag, Engrs. and Archts., 450 4th Ave., will build a 1 story garage on 5th Ave. Estimated cost $25,000.

N. Y., New York—The A. Smith & Sons Carpet Co., 285 5th Ave., awarded the contract for the construction of a 1 story, 71 x 100 ft. garage.

O., Cleveland—Greenwald, Stecher & Wallach, Society for Savings Bldg., awarded the contract for the construction of a 1 story, 125 x 135 ft. garage on Central Ave. near East 14th St. Estimated cost $50,000. Noted May 17.

Wis., Kenosha—The Simmons Co., 160 Exchange St., will build a 2 story, 86 x 246 ft. garage. Estimated cost $60,000.

Wis., Medford—The Frendle Bros Co., c/o H. Grann, owner, is receiving bids for the construction of a 1 story, 50 x 100 ft. garage and repair shop. Estimated cost $40,000. J. G. Schneider, Arcadia, Archt. Noted Apr. 26.

Wis., Plymouth—The Badger State Service Co. awarded the contract for the construction of a 1 story, 40 x 80 ft. garage and repair shop. Estimated cost $40,000.

Wis., Port Washington—Schmit Bros. are having plans prepared for the construction of a 1 story, 52 x 100 ft. addition to garage. Estimated cost $40,000. F. Graf, 307 Grand Ave., Milwaukee, Archt.

Wis., Waukesha—The Quality Aluminum Casting Co., 505 Lake Ave., awarded the contract for the construction of a 1 story, 87 x 200 ft. aluminum foundry. Estimated cost $50,000. Noted Apr. 19.

Wis., West Allis — Hunt & Grissold, Archts., 445 Milwaukee St., Milwaukee, will receive new bids for the construction of a 2 story, 62 x 87 ft. garage on 53rd Ave., here, for the Burbach Auto Service Co., 5225 Greenfield Ave. Estimated cost $40,000. Noted Apr. 19.